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LIST OF CONTRIBUTORS

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All communications to the Editor, 22 Harlington Road East, Feltham, Middlesex, England. Telephone Feltham 3740.

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NEWS AND VIEWS

About one hundred years ago the interest in British entomology from the amateur point of view was probably at its height. *The Entomologist's Weekly Intelligencer* at that period makes fascinating reading. Its style was often intensely personal and interesting. *The Entomologist's Annual* was also being published, and each year this publication listed the species of Coleoptera and Lepidoptera added to the British List during the previous year.

We think that our readers will find interest and entertainment in extracts from these old Journals, and we intend, from time to time, to fill up odd corners by such extracts, under the heading '100 Years Ago', and the first few items are to be found in this issue.

100 YEARS AGO

From *The Entomologist's Weekly Intelligencer,* Sat., 27th Nov., 1858.
To Correspondents:

J.G.—If we exclude all offensive letters we must of course exclude yours, which is one of the most extraordinary epistles we ever received, and we are at a loss to conceive that you really intended it for publication.

THE LEPIDOPTERA OF A DOVER GARDEN

By BRIAN O. C. GARDINER

Sorting over some old specimens from Dover I discovered two that were not recorded in Embry and Youden's List of the Butterflies and Moths found in the Dover and Deal District of Kent (1948). Further reading of the list brought to mind several species I had taken at Dover and which were given as rare or only represented by the occasional specimen, or else were not recorded from the immediate vicinity of Dover. As I have now severed all ties with that town I felt it worth while collating and putting on record my collecting there over a period of twenty years, particularly as the garden in which the collecting was done has now been extensively cleared of trees and undergrowth, and this has probably had the effect of destroying the food-plants of some of the species, e.g. *Abraxas sylvata* (Scop.).

While my collecting has been spread over twenty years, the quantity done has been rather unequal and the remarks in the following list apply chiefly to the years 1943-1954, except in some instances where I have accurate records going back to 1934. Pyrales were not collected seriously before 1943. Tortrices and Tineids were only collected casually except for two years, and consequently I have merely listed these, as it is not possible to give any estimate of their rarity or otherwise. There is no list of the micros from Kent.

To Embry and Youden's total of 136 species of Pyrales from the Dover and Deal area I have added four. I find their total rather high in view of the fact that Beirne, in his *British Pyralid and Plume Moths,* lists only 128 species for Kent as a whole. Since both authors compiled their lists from the literature it is clear that Beirne was more critical of the validity of some of the records.

My collecting at Dover was very sporadic, being confined to school holidays and, later, of shorter periods and odd week-ends. Consequently many of the common species I did not encounter at all as I was not there at the relevant time, although at some period or other I have been there during every month of the year.

The majority of the collecting was done in the daytime and early evening in my father's garden, an area of one and three-quarter acres, well-wooded, situated about two miles out of Dover along the Canterbury road, just short of Kearsney, and at the bottom of the hill leading up to Whitfield and about one mile from Ewell Minnis.

The garden was bounded on one side by a railway cutting, on two by similar gardens, and on the fourth by the Dover-Canterbury road, on the other side of which rises a steep hillside used for occasional grazing by cattle and containing gorse and many wild flowering plants.

Collecting methods consisted mainly of beating the herbage and

netting the moths as they flew out; some sugaring was carried out before 1940, and I remember larger numbers of moths then than I have ever taken since by this method, but no rarities. A light trap as such was not used but windows were left open and the lights left on. I can still remember one night in 1939 when over 400 moths came into my bedroom, a favourable comparison with Mercury Vapour, which was used on one occasion only in 1954. This produced a species not seen in the area for nineteen years, as well as several not found by me previously. Collecting off flowerheads and dusking were also employed frequently.

Owing to the fact that the records are sporadic for certain times of the year whilst continuous from year to year at other times, it is not possible to give an accurate estimate of rarity or otherwise in all cases. This may explain my failure to have found certain species that are described as 'common' from the Dover and Deal area. On the other hand I have taken some species described as 'rare' not uncommonly, and fairly regularly. In the case of *Abraxas sylvata* (Scop.) it is certain that this species had its only breeding site in the Dover area located in my garden, and this is probably true also of *Evergestis pallidata* (Hufn.). It is quite possible that some of the specimens taken (e.g. *Agrotera nemoralis* (Scop.) were carried into the area by a train passing through the cutting at the bottom of the garden, since they are known to occur further inland in areas through which the railway passes.

Odd larvae found were generally kept and bred, but extensive larva beating and searching were not undertaken owing to the difficulties of keeping large stocks when not staying permanently in one place. The only species taken as larvae and not recorded as adults appear to be *Clostera curtula* (L.) and *Apatele rumicis* (L.). Both these records are of interest as the former has not been seen in the Dover area for many years, and then only from Deal, while the latter is a new record for the area.

It should be borne in mind that the following list is not a Mercury Vapour catch record, and this doubtless explains the fact that some species which might be expected to be taken commonly are represented as odd specimens only. On the other hand, species described as rare by Embry and Youden have been taken equally with their common species in some cases. I feel this is due to the collecting methods employed. It is also true to say that some species have undoubtedly been overlooked due to their resemblance to more common species. *Anaitis efformata* (Guen.) being a case in point. With regard to the Butterflies, some of these which could be taken commonly up to 1943 could not be found again when specifically looked for from 1950 to 1953. My general impression over the years with regard to Butterflies is that on the whole they have become much scarcer. Several species of Lycaenidae could always be taken in the garden up to 1943. From 1946 onwards they were not seen. This

could perhaps be explained by the fact that the garden became considerably overgrown during the war and after, but this does not seem to me to be very likely. Nor does it explain the disappearance of the colony of the Adonis Blue from its haunts on the hillside above the garden, and of the Chalkhill Blue from the railway cutting.

The notes on the following species are taken from two sources: (i) from Diary Notes and list of species seen or taken at the time; (ii) from specimens in my collection. In the case of (i) there are undoubtedly several misidentifications in my early days of collecting. Where there could be any doubt I have omitted the record. Other doubtful identifications have been confirmed or corrected from actual specimens still in existence. Of the 508 species of Macros listed in Embry and Youden's list as having been seen since 1930, I have taken 306 species since 1934 in an area of under two acres. Of this total, however, five are new to the area and six are not included in it as they were last taken prior to 1930. A total of twenty-two species is here recorded for the first time from the vicinity of Dover itself or its immediate outlying areas of Kearsney, Ewell Minnis and Whitfield.

The nomenclature used throughout this list is that of Kloet and Hincks (1945) without alteration except that the Butterflies are placed first. In the case of the Tortrices, however, I have, at the suggestion of Mr. J. D. Bradley, placed the latest names, as supplied by him, in parentheses.

Species which are described by Embry and Youden as rare in the area, or which are new records and about which there could be doubt about identification, I have taken a second opinion. I should like to express my thanks in this respect to Mr. J. M. Chalmers-Hunt, who first pointed out several incorrect identifications to me and named some of the material; to the various members of the staff of the British Museum (Natural History) for other identifications, and in particular to Mr. J. D. Bradley, who named almost the whole of the Tortrices and Tineids; and to Dr. E. Scott for checking the occurrence of the Micros elsewhere in Kent.

SATYRIDAE

Dira megera (L.). Commoner in some years than others.
Agapetes galathea (L.). Regularly as odd specimens. Local colonies nearby.
Maniola jurtina (L.). Very common.
Coenonympha pamphilus (L.). Very common.
Aphantopus hyperantus (L.). Occasionally.

NYMPHALIDAE

Vanessa atalanta (L.). Regularly, sometimes very common.
V. cardui (L.). Common.
Aglais urticae (L.). Common.

Nymphalis polychloros (L.). Three specimens at Buddleia blossom, two in 1939 and one 14th August, 1940. This is the earliest record of its reappearance in Dover and has already been reported by Chalmers-Hunt (1953 *Ent. Gaz.* 4, 3.)

Nymphalis io (L.). Common.

Polygonia c-album (L.). Usually not uncommon—ever since 1934. Both larvae and pupae found on occasions.

LYCAENIDAE

Aricia agestis (Schiff.). Not uncommon usually, but scarce of late.

Polyommatus icarus (Rott.). Very common.

Lysandra coridon (Poda). Very common up to 1943. There was a colony on both the railway cutting and hillside. Few seen recently (none in garden) and has disappeared from the cutting.

L. bellargus (Rott.). Occasionally in garden, A good colony on the hillside, but the last specimens were seen in 1943 and I have failed to find it since. Site is now (1957) a housing estate.

Celastrina argiolus (L.). Not uncommon. A gynandromorph was taken in 1943.

Lycaena phlaeas (L.). Common, but has been gradually becoming scarcer during the last few years.

Callophrys rubi (L.). A few seen nearly every year.

Strymon w-album (Knoch). Adults were taken in 1941 and 1942, and ova were also found on wych-elm (*Ulmus glabra*) in the latter year. Not noticed since. Not previously recorded from Dover.

PIERIDAE

Pieris brassicae (L.). Often common, always some.

P. rapae (L.). Common.

P. napi (L.). Common.

Euchloë cardamines (L.). Seen nearly every year.

Colias hyale (L.). One only 1947.

C. croceus (Fourc.). Only three taken.

Gonepteryx rhamni (L.). Several males seen nearly every year, but females only occasionally.

PAPILIONIDAE

Papilio machaon L. One larva was found on fennel in either 1935 or 1936. The resultant pupa died.

HESPERIIDAE

Erynnis tages (L.). Only a few taken.

Pyrgus malvae (L.) Only a few taken.

Thymelicus sylvestris (Poda). Common.

Hesperia comma (L.). A number in 1936 at Buddleia blossom. Not previously recorded at Dover and not seen since, though looked for.

Augiades venata ssp. *septentrionalis* (Ver.). Common.

HEPIALIDAE

Hepialus hectus (L.). A few between 1946 to 1951.
H. lupulinus (L.). Common.
H. fusconebulosus (Deg.). Occasionally.
H. sylvinus (L.). Several in 1943, but only odd specimens in later years.
H. humuli (L.). Common.

ARCTIIDAE

Eilema complana (L.). Distinctly scarce compared with the following species. Several in 1943 and odd specimens before and since.
E. lurideola (Zinck.). Common from 1944 to 1946 with specimens regularly seen since. Not previously recorded from Dover.
Hypocrita jacobaeae (L.). Common every year.
Cycnia mendica (Clerck). Three or four specimens taken before 1942 only.
Spilosoma lutea (Hufn.). Common.
S. lubricipeda (L.). Common.
Arctia villica (L.). One only in 1947.
A. caja (L.). Rare. No larvae found and odd specimens only in some years.
Parasemia plantaginis (L.). Two only 1938.

NOLIDAE

Nola cucullatella (L.). Found regularly in small numbers.
N. albula (Schiff.). One taken in July, 1950, being the third specimen from the area.

CYMBIDAE

Sarrothripus revayana (Scop.). Several in some years.

CARADRINIDAE

Apatele leporina (L.). Two taken in 1954. Not previously recorded from Dover.
A. megacephala (Schiff.). One only in 1944.
A. psi (L.). Taken commonly most years.
A. rumicis (L.). One taken as a larva in 1944. Not previously recorded from the area.
Cryphia perla (Schiff.) Common.
Amphipyra pyramidea (L.). Common nearly every year. This moth, together with the next species, could nearly always be found dead and in reasonably good condition inside the attic window-sills. Not previously recorded from Dover.
A. tragopoginis (L.). Not so common as the preceding species.
Gortyna flavago (Schiff.). Seen occasionally.
Luperina testacea (Schiff.). Common.
Rusina umbratica (Goeze). Odd specimens in some years.
Panemeria tenebrata (Scop.). Odd specimens taken occasionally.

Cosmia pyralina (Schiff.). Taken in 1945 and again in 1954.
C. trapezina (L.). Common.
Caradrina morpheus (Hufn.). Only a few taken.
C. blanda (Schiff.). Only a few taken.
Petilampa minima (Haw.). One only.
Meristis trigrammica (Hufn.). Most years in small numbers.
Thalpophila matura (Hufn.). Odd specimens only.
Phlogophora meticulosa (L.). Common, and at one time or another has been seen in every month of the year.
Euplexia lucipara (L.). Seen in small numbers regularly.
Xylophasia remissa (Hübn.). Seen in small numbers.
X. crenata (Hufn.). Two only in 1945.
X. lithoxylea (Schiff.). Common most years.
X. sublustris (Esper). Taken occasionally in small numbers.
X. monoglypha (Hufn.). Always common.
X hepatica (Hübn.). Taken regularly as odd specimens.
Eremonia ochroleuca (Schiff.). Several specimens in recent years.
Celaena leucostigma (Hübn.). One was taken in 1952. Not previously recorded from Dover and only three from the Dover area.
C. secalis (L.). Common.
Hydraecia micacea (Esper). Regularly in small numbers since 1947. Not previously recorded from Dover.
H. oculea (L.). Regularly in small numbers since 1947.
Procus furunculus (Schiff.). Probably common. This and the next three species I have confused in the past.
P. strigilis (Clerck). Probably common.
P. latrunculus (Schiff.). A few, from existing specimens.
P. fasciunculus (Haw.). A few, from existing specimens.
Agrotis segetum (Schiff.). Common in 1938 and seen in 1939, but not again until 1954.
A. clavis (Hufn.). Common.
A puta (Hübn.). Common.
A. exclamationis (L.). Common.
A. ypsilon (Rott.). Common in 1938 and seen in 1939, but not since.
Peridroma saucia (Hübn.). Common in 1938 and not noted again before 1954.
Ochropleura plecta (L.). Regularly in small numbers.
Amathes c-nigrum (L.). Common.
A. triangulum (Hufn.). A few specimens in 1942, 1944 and 1954.
A. xanthographa (Schiff.). Always very common.
A. umbrosa (Hübn.). Odd specimens taken.
A stigmatica (Hübn.). Found in 1943. Not recorded from Dover, though found in the surrounding district.
Diarsia brunnea (Schiff.). Taken in 1945. Not previously recorded from Dover.
D. festiva (Schiff.). Taken in 1945 and again in 1954.
D. rubi (View.). Only taken as odd specimens.

D. dahlii (Hübn.). Two were taken in 1945. Not previously recorded from the area.
Triphaena pronuba (L.). Common.
T. comes (Hübn.). Common.
T. janthina (Schiff.). Common.
T. interjecta (Hübn.). Odd specimens taken in some years.
Axylia putris (L.). Seen in small numbers regularly.
Lampra fimbriata (Schreber). Two only in 1942 and 1944.
Aporophyla lutulenta (Schiff.). Odd specimens only.
Conistra vaccinii (L.). Odd specimens only.
Tiliacea citrago (L.). One only in 1944. Not recorded from Dover.
Cirrhia fulvago (L.). Odd specimens some years.
Agrochola circellaris (Hufn.). Common.
A. macilenta (Hübn.). One only in 1944.
Parastichtis ypsillon (Schiff.). Odd specimens in 1944 and 1945, and again in 1952. Not previously recorded from Dover.
Eupsilia transversa (Hufn.). Several taken in some years.
Allophyes oxyacanthae (L.). Only one taken, 1938.
Cucullia verbasci (L.). A few specimens in some years, all as larvae.
Xylocampa areola (Esp.). Regularly as odd specimens.
Griposia aprilina (L.). One only in 1939.
Leucania impura (Hübn.). Several in 1945, otherwise as odd specimens in some years only.
L. pallens (L.). Common.
L. lythargyria (Esp.). Common, sometimes in swarms.
L. conigera (Schiff.). Regularly as odd specimens most years.
L. comma (L.). A few specimens in some years.
Orthosia incerta (Hufn.). Odd specimens only.
O. stabilis (Schiff.). Several specimens in some years.
O. populi (Stroem). One in 1949. There are only two other records for the area.
O. cruda (Schiff.). Taken in some years.
O. gothica (L.). Common.
Tholera popularis (F.). Seen regularly.
T. cespitis (Schiff.). Odd specimens in some years.
Panolis griseovariegata (Goeze). One in 1954.
Hada nana (Hufn.) One in 1945.
Miselia compta (Schiff.). Two in 1952.
Hadena bicruris (Hufn.). Regularly, sometimes in fair numbers.
H. cucubali (Schiff.). Regularly, sometimes in fair numbers.
H. serena (Schiff.). Seen every year in small numbers.
H. chenopodii (Schiff.). Seen occasionally.
Diataraxia oleracea (L.). Common.
Mamestra brassicae (L.). Common.
Melanchra persicariae (L.). Odd specimen only, except for 1954 when it was common.

PLUSIIDAE

Zanclognatha tarsipennalis (Treit.) Common.
Z. nemoralis (F.). Common.
Hypena proboscidalis (L.). Common.
Laspeyria flexula (Schiff.). Several were taken in 1954.
Ophiusa pastinum Treit. Odd specimens only in some years.
Scoliopteryx libatrix (L.). Only three specimens altogether.
Catocala promissa (Schiff.). One only in 1935 or 1936. Not previously recorded for the area.
Euclidimera mi (Clerck). One only in 1944.
Ectypa glyphica (L.). One only in 1944.
Phytometra viridaria (Clerck). Odd specimens all before 1946.
Rivula sericealis (Scop.). Regularly in small numbers.
Polychrisia moneta (F.). Two or three seen nearly every year.
Plusia chrysitis (L.). Common.
P. festucae (L.). A number were taken in July, 1954. Not previously recorded from Dover and scarce elsewhere in the area.
P. iota (L.). Specimens in 1941, 1945, 1952, and common in 1954, including one without the Y spot. Previous records for the area are 1930 and 1931 only.
P. gamma (L.). Common most years.
Abrostola tripartita (Hufn.). Odd specimens most years.

LYMANTRIIDAE

Orgyia antiqua (L.). A few regularly.
Dasychira pudibunda (L.). A few in some years, not uncommon in 1938 and 1954.
Euproctis chrysorrhoea (L.) (= *similis* (Fuessly)). Common.
E. phaeorrhoea (Don.). Odd specimens only.
Lymantria monacha (L.). One only in 1945. Not recorded from Dover.

STERRHIDAE

Sterrha virgularia (Hübn.). Common.
S. fuscovenosa (Goeze). Odd specimens in some years.
S. aversata (L.). Common and variable.
S. biselata (Hufn.). Common.
S. dimidiata (Hufn.). Common.
S. trigeminata (Haw.). Common in some years, rare others. Not previously recorded from Dover.
Scopula remutaria (Hübn.). Common.
S. immutata (L.). A few in 1945 and one in 1947. Not recorded from Dover.
S. margine punctata (Goeze). Odd specimen in some years.
S. ornata (Scop.). Regularly in small numbers.
S. imitaria (Hübn.). Regularly in small numbers. Not noticed between 1946-53, but seen 1954.
Calothysanis amata (L.). Common.

GEOMETRIDAE

Hemithea strigata (Müll.). Common.
Hemistola immaculata (Thunb.). Odd specimens in some years.
Jodis lactearia (L.). Common.
Geometra papilionaria (L.). Odd specimens in some years.

HYDRIOMENIDAE

Acasis viretata (Hübn.). In small numbers between 1941 and 1944. Not seen since.
Chloroclystis coronata (Gey.). In fair numbers in 1952 and 1954.
C. rectangulata (L.). Seen regularly. Commoner in recent years.
Gymnoscelis pumilata (Hübn.). Common.
Eupithecia venosata (F.). One only in 1945.
E. absinthiata (Clerck). Common.
E. albipunctata (Haw.). One only in 1943.
E. vulgata (Haw.). Common.
E. centaureata (Schiff.). Common.
E. icterata ssp. *subfulvata* (Haw.). Common.
E. linariata (Schiff.). Odd specimens only.
E. castigata (Hübn.). Odd specimens only.
E. isogrammara (H.-S.). Odd specimens. Not previously recorded from Dover.
E. exiguata (Hübn.). Odd specimens only.
Horisme vitalbata (Schiff.). Regularly in small numbers.
H. tersata (Schiff.). Regularly in small numbers.
Anaitis plagiata (L.). Common.
Philereme transversata (Hufn.). Regularly in small numbers.
Lygris prunata (L.). One only in 1938.
L. mellinata (F.). In small numbers in some years, 1945 and 1952-54. Previously only recorded in 1935.
L. dotata (L.). In small numbers some years.
Plemyria bicolorata (Hufn.). Regularly in small numbers.
Epirrhoe galiata (Schiff.). Regularly in fair numbers.
E. rivata (Hübn.). Regularly in fair numbers from 1946.
E. alternata (Müll.). Common.
Lyncometra ocellata (L.). Common.
Thera obeliscata (Hübn.). Odd specimens in some years all melanic form *obliterata*.
Cidaria fulvata (Forst.). Occasionally.
Chloroclysta miata (L.). One only 1935 or 1936.
Hydriomena furcata (Thunb.). Regularly in small numbers.
Dysstroma truncata (Hufn.). Common.
Ecliptopera silaceata (Schiff.). Odd specimens in some years.
Electrophaes corylata (Thunb.). Odd specimens in some years.
Entephria flavicinctata (Hübn.). Several in 1943 and 1944 only.
Triphosa dubitata (L.). Two in 1944 only.
Earophila badiata (Schiff.). Common.

Coenotephria derivata (Schiff.). Odd specimens in some years.
Euphyia rubidata (Schiff.). Odd specimens in 1945 and 1952.
E. bilineata (L.). Common.
Perizoma affinitata (Steph.). Only one in 1945.
P. albulata (Schiff.). Two only in 1942 and 1945.
P. flavofasciata (Thunb.). Two only in 1945. Not previously recorded from the area.
Asthena albulata (Hufn.). Odd specimens only in some years.
Melantha procellata (Schiff.). Common.
Pelurga comitata (L.). Taken regularly in small numbers. Rare in the area and had not been recorded for some years.
Operophtera brumata (L.). Common.
Hydrelia flammeolaria (Hufn.). Odd specimens in most years.
Oporinia dilutata (Schiff.). Regularly in small numbers.
Xanthorhoë ferrugata (Clerck). Common.
X. spadicearia (Schiff.). Common.
X. quadrifasciata (Clerck). One only in 1946, the same year and within a mile of the last recorded capture of this species in the area.
X. montanata (Schiff.). Common.
X. fluctuata (L.). Common.
Larentia cervinalis (Scop.). Regularly as odd specimens.
Ortholitha limitata (Scop.). Common.
O. bipunctaria (Schiff.). Common.
Colostygia pectinataria (Knoch). Regularly in small numbers.

BREPHIDAE

Alsophila aescularia (Schiff.). Several in 1952 only.

SELIDOSEMIDAE

Opisthograptis luteolata (L.). Common.
Chiasmia clathrata (L.). Odd specimens in some years since 1946.
Itama wauaria (L.). Small numbers in recent years.
Ectropis punctulata (Schiff.). Odd specimens some years.
E. bistortata (Goeze). Several specimens most years.
E. crepuscularia (Hübn.). Odd specimens in some years.
Boarmia punctinalis (Scop.). Several were taken in 1943. Not seen since and not previously recorded from Dover.
Cleora repandata (L.). Common.
C. rhomboidaria (Schiff.). Common.
Ematurga atomaria (L.). Occasional specimens in some years.
Hemerophila abruptaria (Thunb.). Odd specimens some years.
Erannis leucophaearia (Schiff.). Occasionally.
E. progemmaria (Hübn.). Occasionally.
E. aurantiaria (Esp.). Occasionally.
E. defoliaria (Clerck). Occasionally.
Biston strataria (Hufn.). One in 1946.
B. betularia (L.). Taken most years recently.

Abraxas grossulariata (L.). Common.
A. sylvata (Scop.). Taken regularly in small numbers, including larvae (see 1956 *Ent. Rec.*, **68**: 229) last seen in 1954 and possibly now extinct due to tree felling. This was the only locality in the area.
Lomaspilis marginata (L.). Common.
Theria rupicapraria (Schiff.). Occasionally.
Bapta punctata (F.). Regularly in small numbers.
B. bimaculata (F.). Regularly in small numbers.
Pachyonemia hippocastanaria (Hübn.). One only in 1938. Not previously recorded from the area.
Cabera pusaria (L.). Common.
C. exanthemata (Scop.). Common.
Ourapteryx sambucaria (L.). Regularly in fair numbers.
Campaea margaritata (L.). Occasionally.
Anagoga pulveraria L.). Occasionally.
Plagodis dolabraria (L.). One only in 1954.
Selenia bilunaria (Esp.). Common.
S. tetralunaris (Hufn.). Several in 1949. Not previously recorded from Dover and only two previous specimens taken in the area.
Hygrochroa syringaria (L.). Two only in 1954.
Colotois pennaria (L.). Occasionally.
Deuteronomos alniaria (L.). Regularly in small numbers.
D. fuscantaria (Haw.). Odd specimens in some years.
Ennomos quercinaria (Hufn.). Odd specimens in 1943 and 1944. Not previously recorded from Dover.
Gonodontis bidentata (Clerck). Regularly, common some years.
Crocallis elinguaria (L.). Common.

POLYPLOCIDAE

Habrosyne derasa (L.). Not seen until 1954, when it was common.
Thyatira batis (L.). Taken in 1938 and 1939, and again in 1953 and 1954
Tethea duplaris (L.). Occasionally.
T. octogesima (Hübn.). Several in 1954. There is only one previous record from the area.

SPHINGIDAE

Macroglossa stellatarum (L.). Seen occasionally.
Deilephila porcellus (L.). Only two ever taken.
D. elpenor (L.). Found regularly, including larvae, from 1940 to 1945, and again in 1954. Not previously recorded from Dover.
Sphinx ligustri (L.). Occasionally never as larvae in spite of large quantities of privet.
Smerinthus ocellatus (L.). Occasionally.
Dilina tiliae (L.). One only in 1938.
Herse convolvuli (L.). One only in 1934.
Laothoe populi (L.). Occasionally.

NOTODONTIDAE

Clostera curtula (L.). Larvae were found in 1943, but the species has not been seen since. Not previously recorded from Dover, and is only recorded elsewhere in the area from near Deal, where it has not been seen for many years.

Notodonta ziczac (L.). One in 1954.

N. dromedarius (L.). One only in 1954. Not previously recorded from Dover.

Pheosia gnoma (F.). One in 1945. This is the second specimen from the area, the previous one having been taken in Dover in 1899.

P. tremula (Clerck). One each in 1939 and 1945, and several in 1954.

Pterostoma palpina (L.). One in 1954.

Lophopteryx capucina (L.). Odd specimens in some years.

Cerura vinula (L.). One only in 1944.

C. hermelina (Goeze). One only in 1954, the first specimen for nineteen years and only the third from the area.

Phalera bucephala (L.). Common. Larvae abounded in 1935 and stripped poplar trees.

DREPANIDAE

Cilix glaucata (Scop.). Common.

Drepana falcataria (L.). A few in recent years.

D. cultraria (F.). One in 1954.

PHYCITIDAE

Salebria semirubella (Scop.). Odd specimens some years.

Hypochalcia ahenella (Schiff.). Two specimens only in 1941 and 1942.

Nephopteryx obductella (Zell.). Regularly in small numbers.

Euzophera pinguis (Haw.). One only in 1954.

Homoeosoma sinuella (F.). Two only in 1945.

Myelois cribrumella (Hübn.). Occasionally.

Eurhodope suavella (Zinck.). One only in 1945.

GALLERIIDAE

Corcyra cephalonica (Staint.). One only.

Aphomia sociella (L.). Regularly in small numbers.

CRAMBIDAE

Crambus pascuellus (L.). One only.

C. pratellus (L.). Regularly in small numbers.

C. culmellus (L.). Common.

C. hortuellus (Hübn.). Regularly in small numbers.

C. pinellus (L.). One only in 1954.

C. latistrius (Haw.). One only in 1945.

C. geniculeus (Haw.). Several in 1945.

C. tristellus (Schiff.). Common.

PYRAUSTIDAE

Schoenobius forficellus (Thunb.). One only in 1946.

Agrotera nemoralis (Scop.). One only in 1945. Not previously recorded from the area. (See 1951 *Entomologist*, **84**: 171.)

Notarcha ruralis (Scop.). Abundant every year.
Eurrhypara hortulata (L.). Common.
Perinephela lancealis (Schiff.). One only in 1945.
Phlyctaenia ferrugalis (Hübn.). Specimens in some years.
P. nivealis (F.). Common.
P. coronata (Hufn.). Occasionally.
Nomophila noctuella (Schiff.). Common most years.
Pyrausta cingulata (L.). One only in 1945.
P. purpuralis (L.). Occasionally.
P. aurata (Scop.). Common.
P. olivalis (Schiff.). Common.
P. verbascalis (Schiff.). Odd specimens in some years.
P. nubilalis (Hübn.). One in 1945. Not previously recorded from the area.
Loxostege verticalis (L.). Occasionally.
L. palealis (Schiff.). One only in 1945.
Scoparia angustea (Steph.). One in 1943.
S. mercurea (Haw.). One in 1944.
S. cembrae (Haw.). Regularly in small numbers.
S. dubitalis (Hübn.). Several in 1945.
S. basistrigalis (Knaggs). One only in 1944. Not previously recorded from the area.
S. ambigualis (Treit.). One in 1945.
Evergestis pallidata (Hufn.). Taken regularly in small numbers. Not previously recorded from the area.
Mesographe forficalis (L.). Common.

PYRALIDAE

Hypsopygia glaucinalis (L.). A few in 1954 only.
H. costalis (F.). Occasionally.
Pyralis farinalis (L.). One only in 1945.
Aglossa pinguinalis (L.). One only in 1943.

ALUCITIDAE

Platyptilia gonodactyla (Schiff.). Two only in 1943 and 1953.
P. pallidactyla (Haw.). Two in 1943.
Stenoptilia pterodactyla (L.). Several in 1943.
Alucita pentadactyla (L.). Common.
Adaina microdactyla (Hübn.). One in 1943.
Pterophorus monodactylus (L.). Common.

LASIOCAMPIDAE

Lasiocampa quercus (L.). Odd specimens in some years.
Poecilocampa populi (L.). One only in 1952.
Malacosoma neustria (L.). A few in 1954 only.
Philudoria potatoria (L.). Fairly common.
Gastropacha quercifolia (L.). One only in 1954.

ZYGAENIDAE

Zygaena filipendulae (L.). Occasionally.

PHALONIIDAE

Lozopera dilucidana Steph.
Euxanthis angustana (Hübn.). (*Phthlocnoea angustana* (Hübn.)).
E. zoëgana (L.).
E. hamana (L.).

TORTRICIDAE

Cacoecia oporana (L.) (*Archips oporana* (L.)).
Pandemis corylana (F.) (*Tortrix corylana* (F.)).
P. heperana (Schiff.) (*T. heperana* (Schiff.)).
P. cerasana (Hb.) (*T. ribeana* (Hb.)).
Tortrix forsterana (F.) (*Lozotaenia forsterana* (F.)).
T. consimilana (Hübn.) (*Clepsis consimilana* (Hübn.)).
T. diversana (Hübn.).
Cnephasia communana H.-S.
C. chrysantheana (Dup.).
Argyrotoza forsskaleana (L.).
A. conwagana (F.) (*Pseudargyrotoga conwagana* (F.)).
Peronea emargana (F.) (*Acleris caudana* (F.)).
P. variegana (Schiff.) (*A. variegana* (Schiff.)).
P. sparsana (Schiff.) (*A. sparsana* (Schiff.)).

EUCOSMIDAE

Gypsonoma aceriana (Dup.).
Notocelia uddmanniana (L.).
N. rosaecolona (Dbl. H.) (*Gypsonoma rosaecolana* (Dbl.)).
N. aquana (Hübn.) (*Notocelia roborana* (Tr.)).
Eucosma griseana (Hb.) (*Eucosma diniana* (Guen.)).
E. trimaculana (Don.).
E. hohenwartiana (Schiff.) (*Eucosma scopoliana* (Haw.)).
E. foenella (L.).
E. pflugiana (F.).
E. ramella (L.).
E. nisella (Cl.).
E. solandriana (L.).
Argyroploce salicella (L.).
A. betuletana (Haw.).
A. nubiferana (Haw.).
A. ochroleucana (Froel.) (*A. ochroleucana* (Hübn.)).
A. striana (Schiff.).
A. rivulana (Scop.).
A. lacunana (Schiff.) (*A. lacunana* (Dup.)).
Hemimene petiverella (L.).
Pammene aurantiana (Staud.). A pair taken 11.7.43. New to the British List. See 1958 *Ent. Gaz.*, **9**: 60-62 for full description.

Ernarmonia pomonella (L.) (*Laspeyresia pomonella* (L.)).
E. splendans (Hübn.) (*L. splendana* (Hübn.)).

GELECHIIDAE

Telephila durdhamella (Staint.).

OECOPHORIDAE

Batia lunaris (Haw.).
Endrosis sarcitrella (L.).
Borkhausenia pseudospretella (Staint.).
Diurnea fagella (Schiff.).
Carcina quercana (F.).
Depressaria heracliana (L.).
D. atomella (Schiff.).
D. subpropinquella (Stant.).
D. arenella (Schiff.).
D. cnicella (Tre't.). One in 1947. This is a rare and local coastal species. Has been taken at Deal.
D. applana (F.).
D. purpurea Haw. One in 1943. This is a local species and is rarely taken except as a larva.

GLYPHIPTERIGIDAE

Anthophila fabriciana (L.).

ELACHISTIDAE

Elachista rufocinerea (Haw.).
E. argentella (Cl.).

YPONOMEUTIDAE

Prays curtisellus (Don.).
Yponomeuta padella (L.).

GRACILLARIIDAE

Gracillaria syringella (F.).

PLUTELLIDAE

Argyresthia brockeëlla (Hübn.).
A. goedartella (L.).

TINEIDAE

Tineola bisselliella (Hum.)
Tinea pellionella (L.).

ADELIDAE

Nematopogon swammerdamella (L.).

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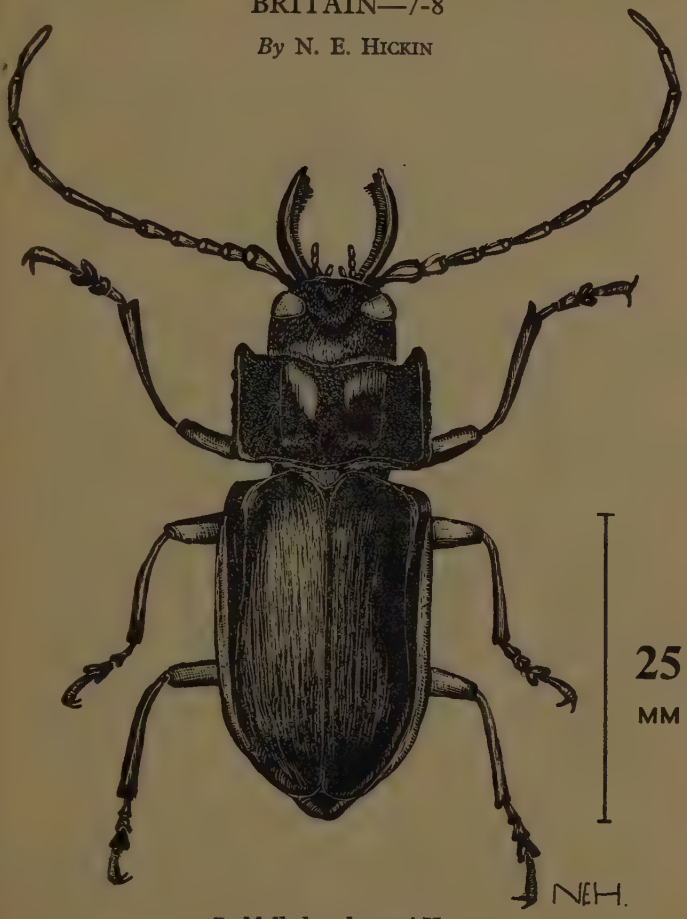
100 YEARS AGO

From *The Entomologist's Weekly Intelligencer*, Sat., 11th Dec., 1858.

Birmingham Natural History Association.—On Wednesday evening, 17th Nov., this Association held its first meeting, in the rooms of the Midland Institute, William Hinds, Esq., M.D., in the chair. The laws were passed, and an enrolment of Members took place. L. W. Clarke, Secretary.

ALIEN INSECTS FOUND ALIVE IN BRITAIN—7-8

By N. E. HICKIN



7. *Mallodon downesi* Hope

This large wholly black member of the *Prioninae* was taken in the West India Dock, London, on 1st December, 1949, and was in the M. G. Frazer collection. The specimen was associated with the West African timber Makore (*Mimusops heckelii* Hutch. and Dalz.), a timber species not given by Duffy as a host plant.

8. *Sipalinus squalidus* Klbe.

This beetle is dull black with many mustard-coloured blotches and spots. The specimen was taken in 'Chanfuta' log from Portuguese East Africa. (I can find no reference to this name in the usual works on timber identification, but a note by Mr. M. G. Frazer accompanying the specimen identifies the timber as *Afzelia* sp.) Ex East African port at Halsall, Lancs., by Mr. M. G. Frazer, on the 26th June, 1948.

(To be continued.)

SOME THOUGHTS ON JEAN HENRI FABRE

By W. K. Ford, M.Sc., F.R.E.S.

The writer, like many naturalists, has often reflected on the life and work of the great French entomologist, J. H. Fabre. He feels that a brief account of Fabre's life and some thoughts on his work may interest readers. Ideally speaking the student of Fabre should possess not only an extensive knowledge of entomology but also of the French language and of France. The combination of such qualifications is not easy to find, which helps to explain why there is not yet a really satisfactory biography of Fabre in English.

Fabre's Life in Outline

Fabre was born in 1823 at the market town of Saint-Léons in the province of Aveyron. His father, stated to be the first of the family to take to town life, was for much of his life a café proprietor but, moving from place to place, seems always to have followed this calling with scant success. At an early age young Jean was sent to live with his paternal grandparents, in order that there might be one less mouth to feed at home. Their home was at Malaval on the Rouergue tableland three thousand feet above the sea. They were farmers, and Fabre tells us that their isolated dwelling among the heath and broom was from time to time visited by wolves.

We are fortunate in having some chapters from Fabre's own pen giving us an account of his early life and education. In one of these entitled 'Heredity'[1] he asks where his own gift for the study of insect life came from. He tells us that his mother was absolutely illiterate while his father could only read a little; his paternal grandparents never opened a book in their lives. All of them would have thought the study of insects a great waste of time.

At the age of seven Fabre returned to Saint-Léons where he attended a school kept by his godfather. He gives a vivid account of this school and of his school teacher, an excellent man who would have taught them very well had he not had so many other things to do. These included managing the property of an absentee landlord and acting as local bell-ringer and barber. At the age of ten Fabre entered the lycée at Rodez—a lycée being roughly the equivalent of a grammar school in this country. Here he made good progress but, his father not prospering, he had to leave his studies and for some time take any work he could get. Fortunately he obtained a scholarship and was able to continue his education at the Normal College of Avignon. At the age of nineteen Fabre became a primary teacher at Carpentras twenty miles to the north-east of Avignon. Here he took up the study of mathematics, and we can read his own account of how he learnt algebra by the process of teaching it to someone

[1] See *The Life of the Fly,* Chapter 5.

else, and of his subsequent studies in analytical geometry. Finally he acquired the degree of Licentiate in the Mathematical Sciences. He also worked at physics and chemistry, and in 1850 was appointed as teacher of these subjects in the lycée at Ajaccio in Corsica.

During these years Fabre had to suppress his interests in natural history since there was then no scope in it for teaching. In Corsica, however, he met the distinguished naturalist Moquin-Tandon, who had come to study the botany of the island. 'Leave your mathematics', he was told. 'Get to the beast, the plant; and if, as I believe, the fever burns in your veins, you will find men to listen to you.' Fabre took this advice and decided that in future natural history was to be his main interest. He was not, however, to stay in Corsica; during his botanical rambles he contracted severe malaria, and in 1853 he returned to teach at the lycée at Avignon.

In 1854 he read a paper which was to shape his course towards entomology. This concerned a wasp of the genus *Cerceris* which hunted beetles of the family Buprestidae. It was written by Léon Dufour, an army surgeon, who on retiring had devoted much time to entomology. The beetles were found to be fresh after being stored for some time as food for the wasp's larvae, and Dufour considered that the poison from the wasp's sting must serve as a preserving agent. This paper led Fabre to his work on the Hunting Wasps. This was the work in which he took the greatest pride, and his chapters on these insects are probably those which the majority of his readers find of most interest. Fabre published a paper on *Cerceris* in the *Annales des Sciences Naturelles*. In 1858 he was awarded the degree of Licentiate in the Natural Sciences before the faculty of Toulouse.

At this time Fabre was aiming at a university post. A friendly school inspector however warned him that he would find the tenure of such a post impossible without some private means. To improve his finances he therefore took up the study of industrial chemistry, proposing to extract the colouring matter alizarin from madder root. In 1867 while working at this project in his laboratory he was visited by Victor Duruy, the Minister of Public Instruction. Some months after he was summoned to Paris by Duruy. He was made a Chevalier of the Legion of Honour and was presented to Napoleon III. He did not stay long in Paris. Never, he tells us, had he felt such tortures of loneliness as in that immense whirl of humanity—to get away was his sole idea.

Unfortunately Fabre's plans to better his financial position came to nothing. He succeeded in obtaining, in a cheap and practical fashion, the pure colouring-matter and found it excellent both for printing and dyeing. One of his friends took up the process on a large scale in his works, while some calico factories which adopted the process expressed themselves as delighted with it. But production had hardly started when news was received that two German chemists

had discovered a process for making the dye synthetically by transforming anthracene into alizarin. Soon the synthetic product was available for practical use, and being cheaper it drove the other from the market.

A further misfortune befell him in 1870. Victor Duruy had started what was then a revolutionary idea—classes for the secular secondary education of girls. Previously any such education had been the privilege of the church. Fabre conducted some of these classes and gave lectures in science. They did not meet with approval. He was even mentioned from the pulpit as a man both dangerous and subversive. The scheme to remove him was, he tells us, plotted with the old maids who owned his house and who saw the abomination of desolation in these new educational methods. He was given four weeks' notice to quit and had no written agreement of any kind to protect him. The first house which he happened to find was at Orange and, filled with disgust, he resigned his position.

Thus ended Fabre's life as a teacher in the narrower sense of that word. Financially his position would have been desperate had not John Stuart Mill come to his aid with a loan of 3,000 francs. Fabre now began to write a series of school books and popular works on science. In time these became very successful and he made a good income from their sales. The experience thus gained was also of value in writing his monumental work the *Souvenirs entomologiques.*

In 1878 Fabre moved again. He took a house on the outskirts of Sérignan, with a 'wild garden' which he called the Harmas,[2] a name given in the district to an untilled pebbly expanse. This garden, with its mighty growth of thistles and centauries, was an earthly paradise for bees and wasps. Fabre was at last free to give most of his time to the work which interested him so intensely. 'It is a little late,' he says. 'I greatly fear that the peach is offered to me when I am beginning to have no teeth wherewith to eat it.' An interesting account of Fabre's house at Sérignan is given by L. O. Howard (1922). He describes it as a good-sized one, having a large garden surrounded by a high wall. In Sérignan is a street named 'Rue de Henri Fabre'. Howard remarks incidentally that Fabre was a tall man, and that photographs taken in his old age when he was stooping and emaciated give a wrong impression of him.

The first volume of the *Souvenirs entomologiques* appeared in the year 1879. In all ten volumes were produced. Although most of Fabre's researches were carried out in his later years some had been started much earlier, and his observations on the Sacred Scarab Beetle for example extended over forty years. At first the volumes were very plainly reproduced, with no illustrations, but later editions with photographs and text figures appeared.

[2] See *The Life of the Fly*, Chapter 1.

For some time Fabre's books gave him a good income, but later they declined in popularity. This is thought to have been due to references to the deity at a time when secular education was the rule. Eventually in 1908 a grant of 500 francs a year was made to him as a tribute to his great learning and excessive modesty. Finally, toward the end of his long life, Fabre found not only appreciation but fame. In 1910, at the Fabre Jubilee celebrations, Government representatives and delegations from French and foreign learned societies gathered to pay him homage. Thus, if rather belatedly, he was amply honoured in his own lifetime. He died on 11th October, 1915.

Fabre's Contributions to Entomology

We may now say a little about Fabre's entomological work. So many were the problems with which he dealt that to give only a brief summary would take up much space. Almost all the contents of the *Souvenirs entomologiques* have been translated into English. In them we may read of the assembling of the Giant Peacock Moth and of the Processionary Caterpillars, of the Sacred Scarab Beetle, and of hypermetamorphosis in beetles. Nor was his interest confined entirely to insects. We have accounts also of the lives of spiders and scorpions. But above all in interest is his work on the Hymenoptera and especially on the Hunting Wasps. This, as we have mentioned, was the work in which Fabre took especial pride, and as it reflects his personality we may give particular attention to it.

Fabre first investigated, following the reading of Dufour's article, the habits of the wasp *Cerceris major*, which hunts a large weevil—*Cleonus ophthalmicus*. He found that these weevils were not killed but paralysed. Their lives could be prolonged for quite a time if they were fed on sugar and water. The weevils were stung once in the thorax, and this Fabre correlated with the fact that in weevils the three thoracic nerve centres (ganglia) are close together. Another wasp studied by Fabre was *Sphex flavipennis*, a hunter of crickets. The crickets were given three stings, the first in the neck, the second between the pro-thorax and meso-thorax, and the third at the base of the abdomen. These again Fabre considered to be related to the position of the ganglia. The most complicated stinging habits of all are, however, found in the wasps of the genus *Ammophila*. The species *A. hirsuta* studied by Fabre preys on the caterpillars of noctuid moths. These it paralyses by a series of up to twelve stings. After stinging, the prey may also be subjected to a process known as malaxation, which consists in compressing the neck of the victim with the mandibles.

Other wasps studied by Fabre include those of the genera *Scolia* which hunt larvae of lamellicorn beetles, *Pompilius* which hunt spiders, and *Tachytes* which hunt mantids. He also studied wasps of the genus *Bembix*, which hunt flies, and have the habit of con-

tinuing to bring their larvae food instead of providing sufficient at once.

In those species in which the prey is paralysed, rather than killed outright, Fabre attached great importance to the victim being stung in the ganglionic nerve centres. He insisted that the stinging was a precise art and that perfection was essential to secure paralysis. If the prey was not efficiently paralysed he thought its movements would kill the egg or young larva of the wasp. If on the other hand the prey was killed outright putrefaction might set in. His contention that the prey is stung in the ganglia is however an inference drawn from the position of the stings, rather than an ascertained fact. Studies by later workers suggest that the position where stinging takes place does not matter as much as Fabre contended. Observation on this matter is not easy. When discussing the Pompilidae, Richards and Hamm (1939) state that it is exceedingly difficult to see what a wasp is doing to a spider. They suggest that confident assertions as to the point of entry of the sting and the number of stings need not be taken too seriously. We may therefore agree with W. M. Wheeler that Fabre's idea of a clairvoyant surgeon is a myth.

There would also appear to be more variation in the effect of the stinging than Fabre's work suggests. Nevertheless in certain species the prey is normally paralysed and stays alive for some time. It is reasonable to conclude that this serves a purpose even if in these species development may occur when the paralysed prey dies rather soon.

Some Verdicts on Fabre and his Work

How is the value of Fabre's work to be estimated to-day? Those most qualified to appreciate him are those who have undertaken similar work. Hugh Main, for example, a skilful student of insect life histories, venerated Fabre and spent holidays in the South of France in order to photograph the insects which Fabre studied. On the other hand the systematic entomologist looks askance at Fabre's neglect of this aspect of the subject.

A balanced account of Fabre's work was given not long after his death by the French entomologist C. Ferton, who was a careful student of the Hymenoptera. He says:[8] 'It is our duty to show our great men just as they were. Their fame will not be diminished by this; and Fabre, in spite of his errors, will remain the great Fabre to whom we owe many beautiful and important discoveries, described in marvellous and enthusiastic language. It is with this thought that I permit myself to make certain criticisms.' Ferton then charges Fabre with betraying ignorance of or not acknowledging the work of others. He points out his carelessness as to the identity of some of the species which he studied. He also charges him with some

[8] See paper by Ferton (1916). The translation of the extract is from Howard (1922).

errors of observation or incorrect statement. Lastly he insists that Fabre's bitter complaints against the material difficulties of life were not justified, and that for many years he was comparatively well off.

As far as the writer can judge these are just criticisms. Indeed we have only to search Fabre's writings for ourselves to find evidence in support of the contentions. Fabre says 'the collector's dried insect interests me very little', and we know that when he visited Paris, instead of mixing with fellow entomologists and seeing the large museums, his sole anxiety was to get away from the place! He also says 'I read very little', and we are told that he was a poor correspondent. C. V. Legros in fact says that this negligence in the matter of correspondence was not least among the causes which mitigated against his popularity. It may be suggested that Fabre would have been an even greater man if he had not been quite such an individualist. Man is a social animal and co-operation is needed for great achievements in science.

Another important comment on Fabre's work is given by W. M. Wheeler in an introduction to P. and N. Rau's book *Wasp Studies Afield*. Wheeler points out that Fabre was influenced by his early studies in mathematics, physics and chemistry. Hence when he came to study insects he was interested in establishing clean-cut laws. Further, he had no sympathy with evolutionary theories, being set in his ways of thinking when the *Origin of Species* appeared. In spite of these criticisms Wheeler ranks Fabre with Latreille and Réaumur, stating that in his opinion they are the three greatest entomologists. Fabre, says Wheeler, is 'so pre-eminent in the wealth and precision of his observations, in the ingenuity of his experimentation and in literary expression, that his *Souvenirs* will always endure'.

Fabre's views on evolution were at variance with those of the great majority of biologists, and he seems particularly to have mistrusted the evidence for evolution by natural selection. Fabre continually quotes the unvarying character of instinct as evidence against evolution. In spite of this, in one very interesting chapter,[4] he does admit that there are exceptions to the iron rule of instinct. He states that the insect in a varying world is capable to some extent of improvement by experience. He adds 'I dare not speak of this rudimentary faculty as intelligence, which is too exalted a title: I will call it discernment'. Writers in England, also unwilling to use the word intelligence, have used the term plastic behaviour. In many of his hunting wasp studies the facts observed by Fabre were closely similar to those of the later observers, G. W. and E. G. Peckham. The inferences he drew were however different. Whereas the evolutionist stresses the variation and the exceptional occurrence, Fabre tends to ignore them.

[4] Chapter 6 in *Bramble Bees and others*. Reprinted in *Mason Wasps*, Chapter 7.

Popular writers in praising Fabre's writing have blamed more orthodox scientists and suggested that all scientific work could be written up in the simple manner of the *Souvenirs entomologiques*. Much as we admire Fabre's style, this is not a practical proposition. The leisured and sometimes even repetitive style of the *Souvenirs* would not be suitable for publication in a modern scientific journal. An author submitting a paper in such a strain would no doubt be asked to reduce its length. On the other hand, judged solely as literature, his work must be given a high place while he ranks among the foremost in popularizing natural history. How different and how much more vital are his books, describing his own experiments, from those of the many popular writers on natural history who describe things at second-hand.

Opinions are likely to differ as to whether Fabre's complaints against the material difficulties of life were unjustified. Some of the trouble seems to have been due to the fact that Fabre, like his father, was not a good manager in the ordinary affairs of life. But teachers were not paid well and we learn that their salaries were even in arrears at times. Fabre had to give private lessons to find sufficient for his large family. We know also that he wished to obtain a University post for which at that time private means were essential. Money worries therefore overshadowed many of his days, and it was only in his later life that he was able to give his whole time and energy to the work he enjoyed so much. Under such difficulties it is no wonder he felt frustrated and dramatized his feelings in his writings. When, for example, he says 'For forty years have I fought, with steadfast courage, against the paltry plagues of life' he is surely only telling the truth.

Among admirable personal qualities of Fabre are his affection for his family and his general love of children. Fabre married twice. His first wife died soon after he retired to Serignan. There were five children of this marriage. He married again and there were three children of the second marriage. His children assisted him in his work and their names often occur in the *Souvenirs*.

Fabre's shortcomings, if we may use so hard a term, are the defects of his many fine qualities. E. W. Teale has rightly said that when all his weaknesses are acknowledged, the greatness of Fabre towers above them. Fabre's emphasis was always on fundamentals and he shines in contrast with those workers who Darwin [5] described as 'the mob of naturalists without souls'. Comparing him with Darwin among much that is so dissimilar in the background of their lives, we may say that both were concerned in the struggle for truth and that in this struggle both showed courage and persistence in a high degree. Fabre also resembled Darwin in being a pioneer, and when progress is made pioneers are sometimes forgotten.

[5] In a letter to H. W. Bates. See *The Life and Letters of Charles Darwin*, Vol. 2, p. 393.

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BREEDING *PAPILIO DARDANUS* BROWN IN ENGLAND

Dr. P. M. Sheppard, of the Department of Zoology, Liverpool University, and I are breeding *Papilio dardanus* on a large scale partly to elucidate the genetics of the various forms of mimetic and non-mimetic females, and partly, by means of race crosses, to throw light on the evolution of the mimetic patterns. Until this year we were dependent on citrus leaves for the food plant of the caterpillars, but we have now discovered that it can be fed with much lower mortality on *Choisya ternata* (the Mexican orange plant). This is a hardy evergreen and is not uncommon in big gardens in this country. We are already using all the local supplies that we know of and we should be most grateful if anyone in any other part of the country who has a bush could send us regular supplies of the leaves, once every week or fortnight for the next few months. The leaves travel and keep extremely well in polythene bags. We should be willing to pay postage and supply the bags.

DR. C. A. CLARKE.

High Close, Thorsway,
Caldy, Cheshire.

ECOLOGICAL SEGREGATION IN BUTTERFLIES IN BRITAIN

By D. F. Owen

Introduction

It is almost an axiom of modern thought on evolution through natural selection that two or more animal species living in the same area have or tend to have different ecological requirements. This principle is usually termed Gause's thesis (see Gause, 1934), and it has been widely applied in many groups of vertebrates and some invertebrates. Particular attention has been focussed on examples in birds (see Lack, 1954 for references). Ecological differences have been most studied in closely related (congeneric) species, and it is usually stated that the differences in ecology have been evolved through natural selection, and reduce the possibility of interspecific competition. This paper is about the ecological differences between species of butterflies in Britain and the possible significance of such differences in speciation. It is well known, for instance, that five or six species of Lycaenid butterflies may live in the same field in southern England, yet each has a different food-plant or feeds at a different time of year. Why should this be so?

It is unlikely that in vertebrates and higher invertebrates the readily observed ecological differences between related species are due initially to differences in physiological tolerance; objections to the idea of such pre-adaptation are given by Mayr (1947). Nor is it likely that recognition factors alone restrict an animal to a particular environment. More reasonably, habitats and other ecological requirements are determined by selection. It is remarkable how rarely species of animals are found outside their typical habitats, and from this alone we may deduce that there is considerable selective advantage in becoming specialised to a particular habitat.

In vertebrates, such as birds, and also in the butterflies considered here, it seems certain that ecological segregation alone cannot give rise to subspecific or specific differentiation (but see Thorpe, 1945); there is no evidence for sympatric speciation in such animals as these (Mayr, 1947). But populations, evolved in geographical isolation, can give rise to species when and where any two meet (Mayr, 1942), but when this happens there is a genetic and an ecological problem (Lack, 1949). What are the possibilities when two forms, differentiated in geographical isolation, meet?

First, if they are still subspecies, they can interbreed and mix and there is no further differentiation, and also no trace of what has happened is left for the present-day observer. Secondly, if in isolation they have reached specific rank and when they meet they are not equally adapted, one might eliminate the other (again no trace is

left), or there might be geographical replacement in different areas. Thirdly, if they are more or less equally adapted, yet have become specifically distinct, there might be interspecific competition of one kind or another, followed by ecological segregation, in which the habitat is wholly or partially shared, one species becoming adapted to one part and the other to another. Ecological segregation may occur in a variety of ways, for instance in butterflies by differences in habitat, larval food-plants, parts of the same food-plant exploited, seasonal abundance or time of appearance of the larvae or adults, flowers visited by adults, etc. There might also be selection for avoiding a particular predator or parasite, common to both species, by different means.

In birds almost all the differences in ecology so far examined in detail are concerned with food and feeding places. Similar species may take different kinds of food, feed in different parts of the habitat or take foods of different sizes. There may or may not be a wide range of overlap and the differences may be restricted to certain seasons when food is short. Sometimes it has been possible to show that where two species occur together they differ in ecology, but in areas where only one occurs, it tends to fill the niche of both species. One well-known example is the European Chaffinch *Fringilla coelebs,* which is common in broad-leaved and coniferous woods throughout its range, but in the Canary Islands of Tenerife and Gran Canaria it does not breed in conifers, where a closely related species, *Fringilla teydea,* breeds. This species is considered to have evolved from an earlier invasion of the islands by *F. coelebs*. On Palma, another island in the group, *F. teydea* is absent, and here *F. coelebs* breeds in coniferous and broad-leaved woods. Thus the absence of *F. coelebs* from conifers where *F. teydea* occurs is inferred to be due to competition, the latter being more successful in this habitat than the former. Several similar examples of this are known in birds.

If we are able to show that there are ecological differences between two similar species of animals, then it seems very probable that at some time in their evolution they have competed. Competition between them may not often be obvious at the present day, since selection is continually operating to reduce its severity, and thus ecological segregation is maintained between them.

The butterfly fauna of the British Isles is relatively poor, and in order to test Gause's thesis further with butterflies, a much richer, preferably tropical, fauna should be studied. It must be stressed that, even in Britain, precise details of the food-plants of many butterflies are still not known. We can usually list the particular plants a species eats, but we rarely know how often it eats each one; lists of food-plants have only a limited value. Also, only natural food-plants should be considered, as in captivity a species will often eat plants which in the wild it never eats. There is great scope for

a more quantitative approach to the biology of butterflies and it is to be hoped that in the future this may be possible. In addition, it must be remembered that the butterflies present in this country at the present day did not evolve here, but have arrived since the third Pleistocene glaciation (Ford, 1945), so that many of the ecological differences about to be discussed may have been evolved before the species arrived in Britain. Another point of importance is that on the Continent many species have a wider range of habitats than they have here, and in a more detailed survey of this kind this would have to be taken into consideration.

Ecological Segregation

Ecological details of the species here discussed have been taken from the standard text books on British butterflies, such as Frohawk (1934), South (1947), and also from Ford (1945), while I have in addition used my own information. Details of the food-plants of larvae have been largely taken from Allan (1949). Throughout this paper 'food-plant' refers to that eaten by the larvae. The families of butterflies will be taken in systematic order, groups of closely related (congeneric) species being discussed first. Scientific names of plants have been taken from Clapham, Tutin and Warburg (1952).

Closely related species

For convenience species are here regarded as closely related when they have been placed in the same genus in a modern check-list, such as that of Heslop (1947), but I have made a few exceptions (indicated in the text) where a closely related species is not placed in the same genus.

Satyridae. All the species feed on grass and precise data on food differences (if any) of certain species are difficult to obtain, as the larvae are not often found in the wild, and in captivity will often eat any grass. The chief known differences in the closely related species are differences of habitat. Thus, *Pararge aegeria* (L.) is found in woodland where it hardly ever visits flowers, whereas *P. megera* (L.) is found in open country, especially in sunny places, and frequently visits flowers. *Maniola tithonus* (L.) is a hedgerow species, but it also occurs in woods and, more locally, in other habitats, such as marshes. It overlaps considerably with *M. jurtina* (L.) which is a common species in most grassy places, though scarcer in the more wooded areas where *M. tithonus* is most common. *Coenonympha tullia* (Müll.) is a northern species occurring on damp moorlands and peat bogs. At least in south-west Scotland, *C. pamphilus* (L.), which it closely resembles, is almost completely absent from these habitats, but it is otherwise common in most grassy areas in Britain, especially dry places. In addition, the two species appear to have mainly different food-plants, and *C. tullia* flies at a time of year between the two broods of *C. pamphilus*. *Erebia epiphron* (Knoch) is in Britain confined to mountain tops where it feeds on *Nardus stricta*

L., whereas *E. aethiops* is found on rather high moorland fields and feeds on *Molinia caerulea* (L.) and *Aira caespitosa* L. Further, *E. epiphron* flies in late June and *E. aethiops* in August.

NYMPHALIDAE. In the Argynnidi the five species of *Argynnis* occurring in Britain all feed on violets *Viola* spp. *A. cydippe* (L.) and *A. aglaia* (L.) are very similar in appearance, yet are ecologically distinct, the former being confined to broad-leaved woods and the latter to open country, especially downs, moors, and hillsides near the sea. Note, however, that in the north where *A. cydippe* is absent, *A. aglaia* tends to spread into woods as well as occupy the open country. *A. paphia* (L.) is another woodland species, rather different in appearance from the two mentioned above, but very similar ecologically to *A. cydippe*. Slight differences in habitat, overwintering habits and time of appearance have been found, and on the Continent *A. paphia* has a wider range of food-plants. The two small species, *A. euphrosyne* (L.) and *A. selene* (Schiff.) both appear much earlier in the year than the above species, and both are common in woodland clearings. *A. selene* is more common in the north and appears about three weeks later than *A. euphrosyne*. Three similar species, *Melitaea athalia* (Rott.), *M. cinxia* (L.) and *Euphydryas aurinia* (Rott.) are in Britain (though not always on the Continent) clearly isolated geographically. *M. athalia* is found in woods in the south feeding on cow-wheat, *Melampyrum* sp., *M. cinxia* is more or less restricted to the south coast of the Isle of Wight and feeds on plantains *Plantago* spp., and *E. aurinia* occurs locally on chalk downs and in damp fields throughout Britain and feeds on scabious *Scabiosa* spp.

In the Vanessidi, *Nymphalis io* (L.) feeds on nettles *Urtica dioica* L., and *N. polychloros* (L.) on elm *Ulmus*, and a third species, *N. antiopa* (L.), a rare migrant to Britain, feeds on willow *Salix* spp. *Aglais urticae* (L.) may also be considered here; it feeds on nettles like *N. io*, but earlier and again later in the year. Two migrants, *Vanessa atalanta* (L.) and *V. cardui* (L.), which do not normally pass the winter in Britain and whose numbers fluctuate markedly from year to year, feed on nettles and thistles *Carduus* respectively, though *V. cardui* has a wider range of food-plants in South Europe and North Africa, and in Britain is sometimes found on nettles.

LYCAENIDAE. Most species are ecologically separated by having different food-plants. Thus, in the Theclinae, *Thecla quercus* (L.) feeds on oak *Quercus* and *T. betulae* (L.) on blackthorn *Prunus*, and *Strymonidia pruni* (L.) feeds on blackthorn and *S. w-album* (Knoch) on elm. *T. betulae* differs from *S. pruni* as the larvae feed on the short stunted bushes, whereas those of *S. pruni* feed high up on the older bushes.

In the Lycaenini, *Lycaena phlaeas* (L.) is widespread and feeds on several species of dock *Rumex*, whereas *L. dispar* (Haw.) (extinct, but reintroduced) is confined to wet places and feeds chiefly on the great water dock *Rumex hydrolapathum* Huds. Most species of the

Polyommatini are morphologically very distinct and are thus placed in different genera and therefore will be considered later, but two similar species, *Lysandra coridon* (Poda) and *L. bellargus* (Rott.) live in the same habitat and eat the same food-plant, the horse-shoe vetch *Hippocrepis comosa* L. *L. bellargus* is double-brooded and *L. coridon* flies at a time between the two broods of *L. bellargus*. We may deduce from this that the larvae of the two species eat the maximum amounts of food-plant mainly at different times of year.

PIERIDAE. Of the Pierinae, *Pieris brassicae* (L.) and *P. rapae* (L.) feed mainly on cultivated cruciferous plants (especially cabbages), but the larvae feed largely on different parts of the plant, *P. brassicae* fully exposed on the outside leaves and *P. rapae* on the inside leaves, often right in the heart of the cabbage. A third species, *P. napi* L., chiefly occurs in woods and damp fields and also feeds on cruciferous plants, but of different species, while another species, *Pontia* (*Pieris*) *daplidice* L., a rare vagrant to Britain, feeds on mignonette *Reseda* spp.

Two species of Coliadinae, *Colias croceus* Geoff. in Fourc. and *C. hyale* (L.) are both migrants to Britain, and are ecologically very similar, both feeding on lucerne *Medicago sativa* L., clovers *Trifolium* spp. and other Leguminosae, and, like many migrant insects, they range over a wide variety of habitats. Differences in ecology might be more evident where both species are resident. A third and little known species, *C. calida* Verity, is morphologically very similar to *C. hyale*, but feeds on horse-vetch *Hippocrepis comosa*.

HESPERIIDAE. *Thymelicus sylvestris* (Poda) is common in grassy places, but is less common and sometimes absent where *T. lineola* (Ochs.) occurs. Thus, in North Kent, *T. lineola* flies in low-lying marshy places and other areas near the coast, and *T. sylvestris* in rough fields further inland, though there may be considerable overlap. A third species, *T. acteon* (Rott.), has a very restricted range in Britain, being almost confined to the Dorset coast. It flies in July and August, about a month later than the other species. *Ochlodes venata* and *Hesperia comma* (L.) (similar species) live in different habitats, the former in many grassy places, and the latter on dry chalky hillsides. *O. venata* flies in June and July and *H. comma* in August and September.

Species in different genera

There are a number of species of butterflies which in Britain are the only representatives of their genus, and these will now be compared with their nearest relatives.

SATYRIDAE. *Melanargia galathea* (L.) occurs on rough hillsides and in grassy places (especially on the chalk and limestone) and overlaps widely in habitat with such species as *M. jurtina* (L.) and *M. tithonus* (L.). *Eumenis semele* (L.) is confined to heathland, chalk down and certain dry woods, and thus differs from the other Satyrids. *Aphantopus hyperantus* (L.) occurs in many of the habitats occupied by

M. jurtina and *M. tithonus*, but at least in North Kent *M. tithonus* is rare or absent on the chalk, where *A. hyperantus* is most common.

NYMPHALIDAE. *Polygonia c-album* (L.) occurs in woods, but has spread into gardens and similar habitats. It feeds mainly on hops *Humulus lupulus* L., and red currant *Ribes rubrum* agg. (also nettle), and thus has mainly different food-plants from other Nymphalids. Two other species are confined to woods in southern England; *Apatura iris* (L.) feeds on sallow *Salix* spp. and *Limenitis camilla* (L.) on honeysuckle *Lonicera periclymenum* L.

LYCAENIDAE. The remaining member of the Theclinae to be considered, *Callophrys rubi* (L.), feeds on a great variety of plants, chiefly Leguminosae, and thus differs from the other species.

The five species of Polyommatini not yet discussed are clearly ecologically separated, both from each other and from the two species of *Lysandra* already mentioned. *Celastrina argiolus* (L.) occurs in woods and gardens and feeds on holly *Ilex aquifolium* L., and ivy *Hedera helix* L. *Plebejus argus* L. occurs on heathland (where other Lycaenids are scarce), and to a small extent on chalk downs. *Cupido minimus* (Fues.) occurs on chalk and limestone and feeds on kidney vetch *Anthyllis vulneraria* L. *Maculinea arion* (L.) feeds on thyme *Thymus* spp., but is also symbiotic with certain species of ants. (Possibly other Lycaenids are symbiotic with ants.) *Aricia agestis* (Schiff.) occurs in rough fields and feeds on rock-rose *Helianthemum chamaecistus* Mill., hemlock stork's bill *Erodium cicutarium* L., and possibly other similar plants.

PAPILIONIDAE. The only British species, *Papilio machaon* L., is restricted to marshy places in the east where it feeds on various Umbelliferae. (*Papilio podalirius* L., a common European species, feeds on *Prunus*.)

PIERIDAE. *Anthocharis cardamines* (L.) is similar ecologically to *Pieris napi*, but feeds mostly on cuckoo-flower *Cardamine pratensis* L., and hedge mustard *Sisymbrium officinale* (L.). *Leptidea sinapis* (L.) is a woodland species and feeds on the pea *Lathyrus* spp., thus differing from other Pierids, and lastly, *Gonepteryx rhamni* (L.) feeds on alder buckthorn *Rhamnus frangula* L., and buckthorn *R. catharticus* L.

RIODINIDAE. The only species in Britain is *Hemearis lucina* (L.), which occurs in woods (especially in glades and along paths) and feeds chiefly on cowslip *Primula veris* L.

HESPERIIDAE. *Pyrgus malvae* (L.) and *Erynnis tages* (L.) live in similar habitat, but the former feeds on the vetches *Lotus corniculatus* L., *Hippocrepis comosa* and others, whereas the latter feeds on strawberry *Fragaria vesca* L., cinquefoil *Potentilla* and bramble *Rubus*. *Carterocephalus palaemon* (Pall.) occurs in woodland and feeds on the grasses *Bromus ramosus* (Huds.) and *Brachypodium sylvaticum* (Huds.).

DISCUSSION

It is evident from the foregoing account that ecological differences in butterflies in Britain may be listed as follows: (1) larval food-plant; (2) feeding place of larva; (3) time of appearance (including number of broods); (4) habitat; (5) flowers visited by the adult butterfly. In some instances it is likely that feeding on a certain food-plant automatically restricts the habitat, simply because the food-plant is restricted. Where there are several ecological differences between related species it is not always possible to say which is the most important.

Closely related species

The differences in ecology in the closely related species of butterflies in Britain are in general agreement with Gause's thesis, possible exceptions being *Argynnis paphia* and *A. cydippe,* and *Colias croceus* and *C. hyale.* There are certain slight differences in the first pair which should be studied further, and the two species of *Colias* are migrants to Britain, and, in common with most other migrant species, range over a wide variety of habitats.

The most frequent difference in the closely related species is that of the food-plant or feeding place of the larva, suggesting that at some time in the evolutionary history of the species competition for food has occurred. Instances where two species live on the same food-plant are particularly interesting. The larvae of *Pieris brassicae* and *P. rapae* both feed on cultivated cruciferous plants, the former gregariously and exposed on the outside leaves and the latter solitarily and concealed. Other closely related species on the same food-plant feed at different times of year (*Aglais urticae* and *Nymphalis io, Lysandra bellargus* and *L. coridon*) or on different parts of the same food-plant and at different times of year (*Thecla betulae* and *Strymonidia pruni*).

More positive evidence of one species restricting the habitat of another is where in the absence of one the other occupies its habitat, just as with the Chaffinches on the Canary Islands, already cited. I have only been able to find one instance of this in British butterflies. In England, as far north as Westmorland, *Argynnis aglaia* and *A. cydippe* occur in rough open country and woodland respectively, but further north than this *A. aglaia* only is found, and here it also flies in woodland (Ford, 1945, Owen, 1953), as well as in open country. Other examples of this in butterflies would be most interesting.

Unrelated species

There is some evidence of greater ecological similarity between certain unrelated species than between species in the same genus. Almost certainly this is due to convergence, in which species from different genera and families have become independently adapted to similar habitats and other ecological conditions. In taxonomy morpho-

logical convergence is familiar, and many of the morphological features of an animal are, through selection, due to environmental factors. Two species of butterflies in different families, *Eumenis semele* (Satyridae) and *Plebejus argus* (Lycaenidae) each occur in either heath or chalk, though, of course, they have quite different food-plants. Both species have darker forms on the heath and paler forms on the chalk, which in *E. semele* are correlated with the concealing behaviour of the butterfly, though in *P. argus* the two forms are not obviously adaptive. Other species, in different families, may have the same food-plants (*Pyrgus malvae* and *Polyommatus icarus*), and species in the same family, but in different genera, may have similar habitats and food-plants (*Anthocharis cardamines* and *Pieris napi*). But there may also be morphological convergence without any obvious similarity in ecology (*Melitaea athalia* and *Hemearis lucina*).

Competition

Ecological segregation between closely related species appears to have been evolved as a result of competition. It is perhaps difficult to realise how any of the butterflies considered here could ever be abundant enough to compete, especially to compete for food-plants. The habitats in which we now see the various species have almost all been changed by man, and in some respects we are seeing them in unusual surroundings, certainly different surroundings from those in which they were evolved. Even so, it is possible to see that some species of butterflies, and more especially some moths, can be common enough to reach a density where interspecific competition occurs. Thus the two species of *Pieris* which feed largely on cabbages often become so numerous (due largely to immigration) that the larvae strip the plants of their leaves and then wander off in search of further supplies of food. Plagues of some species of butterflies, such as *Euphydryas aurinia* have been described, and there are a number of moths, such as *Bupalus piniaria* (L.), *Lymantria dispar* (L.) and *Cerapteryx graminis* (L.), which periodically eat out a large proportion of their food-plants. When the environment is unusual, as on the London bombed sites after the last war, the numbers of many insects, including Lepidoptera, may become very high because of a prolific growth of plants and a scarcity of predators, parasites and perhaps virus diseases. For some species the food-plants later became scarce on the bombed sites due to defoliation by insect larvae. Immigration from abroad might also be important, especially as the annual reports of migrant insects show that many more species than was previously thought are at least partial migrants. These migrants are potential competitors with the resident species, especially as they often range over a wide variety of habitats and eat many different food-plants.

Morphological and behavioural adaptations

Here it is intended to consider some of the morphological and behavioural changes which may be evolved once a species becomes

restricted to a certain habitat or way of life. The gregarious larvae of *Pieris brassicae* are warningly-coloured and have special glands which secrete a noxious compound, whereas the green solitary larvae of *P. rapae* do not have an unpleasant smell. Just before pupation the larvae of both species leave the food-plant and pupate solitarily, both species having highly variable pupae which match the background. Thus the marked difference in the feeding places of the larvae of these two species, which reduce the chances of competition, lead to the development of different colours, behaviour and scents.

The subspecies of *Pararge aegeria* found in Britain is more or less confined to woodland, especially where there are well-defined alternate areas of bright sunshine and deep shade. The butterflies fly when the sun shines and move rapidly between the sunny and shady areas and, because of their coloration (dark brown with pale spots), they are hard to follow with the eye, and hence a combination of coloration and flight behaviour might reduce the chances of predation. In South Europe *P. aegeria* flies in much more open country and is less restricted to woods, and here its coloration resembles that of *P. megera*, which in Britain also flies in open country. Thus the dark coloration in the British *P. aegeria* seems adapted to life in shady woods. Further, in England *P. aegeria* is double or triple-brooded and passes the winter in hibernation either in the larval or pupal state. Those individuals which have passed the winter as pupae emerge early in the spring and have larger pale spots than those (in the same brood) which emerge later from the winter larvae. Subsequent broods in summer and autumn resemble in coloration the second part of the first brood. The difference in coloration between the two parts of the first brood is presumably controlled by temperature affecting the expression of certain genes (perhaps as in *Araschnia levana* L. (Süffert, 1924)), and the pale coloration of the early spring butterflies is evidently adaptive, as these individuals fly at a time of year before the leaves are on the trees, and there is thus less contrast between the sunny and shady parts of a wood. A paler form would therefore be advantageous. It is interesting to note that when A. J. Showler and I examined specimens of the southern form of *P. aegeria* from Cyprus (in the Natural History Museum, London) we were unable to detect any seasonal variation of the type found in the British subspecies. If in Cyprus the butterflies are also not restricted to woodland, seasonal variation would not have the survival value that it appears to have in Britain. A more detailed analysis of these facts is urgently required, but in support of the preceding remarks attention must be drawn to the fact that *P. megera*, which in Britain lives in open country and has two or three broods in a year, does not vary seasonally. Fourteen other species of butterfly in Britain regularly have more than one brood in a year, and of these seasonal variation in colour and marking occurs in six (this excludes the four migrant species). Besides research into the genetics of seasonal variation in

butterflies, it would be interesting to find to what extent such variation is adaptive, especially in a species like *Polygonia c-album*, in which seasonal variation is linked with a complicated life cycle.

As already indicated, *Eumenis semele* varies in coloration with the habitat, being paler on chalk than on heath. When the butterfly settles on the ground it first displays the eye-spot on the underside of the forewings, thus giving any predator a chance to attack it in an unimportant part, and then, after a few seconds in this position, the forewings are covered by the highly cryptically coloured hindwings and eye-spot disappears. The butterfly then leans to one side and this eliminates shadow which might otherwise give its position away. It then resembles the ground perfectly and is almost impossible to detect. Thus in this species, colour, markings and behaviour are all adapted to the habitat in which the butterfly lives and give it maximum protection.

Other examples such as those cited above will be recalled by the field observer of butterflies. Almost all need more careful study, and information of a quantitative nature would be valuable, especially with reference to vertebrate predators.

Interspecific recognition

There is a possibility that some of the morphological and behavioural, and perhaps ecological, differences between closely related species of butterflies might be a means of interspecific recognition, which would tend to minimise attempts at interbreeding. Adaptations could presumably evolve which would tend to reduce the chances of unfavourable matings, and such adaptations might take the form of differences in colour, marking, shape, size, time of appearance, scent and habitat. It will be evident that many of these differences have already been considered in relation to ecological segregation due to competition. But this would only apply to adults, not larvae, where in fact the more striking ecological differences occur. A possible case where a difference in time of appearance might tend to reduce the chance of cross-matings in two congeneric species may be considered here. *Lysandra coridon* and *L. bellargus* live in the same habitats but fly mainly at different times of year. The females, but not the males, are extremely similar in appearance, and the fact that the two species do not overlap much in their times of appearance might reduce the chances of cross-matings (which are in fact known). Thus it is possible to postulate differences in the times of appearance evolved on the one hand to reduce competition, and on the other to reduce the chances of cross-matings, though it is difficult to see why the two species have not evolved differently marked females if the frequency of such cross-matings is high.

Speciation

Some species of butterflies in Britain have evolved into distinct subspecies (*Papilio machaon*), others show marked geographical varia-

tion within their range, which may either be in the form of a cline (*Aphantopus hyperantus*), or as distinct isolated populations (*Carterocephalus palaemon*). Other isolated populations of the same species do not exhibit geographical variation (*Pararge aegeria*). Many Irish and Scottish butterflies differ slightly from those in the rest of Britain, both in morphology and habits (such as the number of broods).

Populations evolved in isolation can give rise to species when the two meet (Mayr, 1942), and it is therefore worth considering the possibility of this occurring in butterflies in Britain. *Coenonympha tullia* has a northerly distribution in Britain and the Scottish subspecies has smaller and fewer spots than another subspecies which occurs further south in northern England. When butterflies from Scotland (Caithness) were crossed with butterflies from England (Cumberland) intersexes were produced among the female, but not the male, progeny (Ford, 1955), and this might be considered to be the first step in reproductive isolation between the two subspecies which might eventually lead to speciation. Crossing between other geographically isolated populations would be most instructive.

Conclusion

Closely related species of butterflies in Britain are in most instances ecologically segregated from one another, such segregation being more striking in morphologically similar species (such as *Argynnis aglaia* and *A. cydippe*, *Pieris rapae* and *P. brassicae*), and less so in rather unlike species (*Argynnis cydippe* and *A. paphia*, *Pieris napi* and *Anthocharis cardamines*). On the other hand quite unrelated species may be ecologically similar (*Eumenis semele* and *Plebejus argus*).

The ecological differences between closely related species are thought to have been evolved when two populations, genetically dissimilar, meet and compete, and then each becomes adapted to a different part of the habitat, thus reducing the chances of interspecific competition. Having become ecologically segregated a species may become further morphologically and physiologically distinct as a result of becoming adapted to a particular way of life. Thus several closely related species with ecological, morphological and physiological differences may exist in the same geographical area.

ACKNOWLEDGMENTS

I am grateful to many lepidopterists and zoologists who have discussed these ideas with me and have read critically earlier drafts of this paper. A. J. Showler, N. P. Ashmole, A. J. Cain, J. F. Burton, C. M. Perrins and Mrs. J. Owen have been particularly helpful in the preparation of the present draft of the paper.

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RECENT LITERATURE

Proceedings and Transactions of the South London Entomological and Natural History Society for 1957. Published October, 1958. Pp. xli; 147. Eight plates (3 coloured). 27 figs. Wrappers Price £1 2s. 6d.

This annual treat for British Entomologists has once more arrived on our desk. It is a pleasure to again praise its contents, production and presentation. Two of the coloured plates illustrate the keenly anticipated continuation of *Larvae of the British Lepidoptera not figured by Buckler* (Part II, compiled and illustrated by G. Haggett). The other coloured plate illustrates *The British Eriocraniidae and Micropterygidae* by J. Heath (all the British species are illustrated).

Two plates illustrate some of the aberrations of Lepidoptera shown at the Annual Exhibition of the Society. Another plate is to show some of the known variations of *Euchloë cardamines* L., and illustrates a paper on the subject by H. B. Williams, Q.C., LL.D. Two more plates continue the excellent plan of publishing pictorial records of entomologists present at field meetings—but what a pity that one of them has a wrong name ascribed to one of those members portrayed—the legend to Plate III (the meeting at Challock, Kent, on 8th June, 1957), says 'S. Wakely', when in fact it should be 'Sir L. Wakely'. As both persons are members of the Society this could cause confusion to some future writer.

The President's Address by Dr. B. P. Moore on *The Systematic position of the Tiger Beetles* is as thorough as we have come to expect from this first-class entomologist.

Space forbids mention of other meritorious contents. A few typographical errors occur, but they are of little consequence, and in any case, as any editor will affirm, are unavoidable in a volume of this size no matter how much care goes into its preparation.

E.W.C.

NOTES ON IRISH COLEOPTERA

By C. A. COLLINGWOOD

A number of beetles were collected during a tour of Ireland in June, 1957. Most of these are common and widely distributed throughout the British Isles. A very few of these appear to be recorded from Ireland for the first time, and since there has been little published information on Irish beetles in recent years, the following notes and list of captures may be of some interest. I am indebted to Mr. A. W. Stelfox for the loan of a copy of Johnson and Halbert (1902), with some interesting annotations by the late Eugene O'Mahony. The nomenclature below follows Kloet and Hincks (1945). Locality and other details are given for the more local species.

MYRMECOPHILES

There are very few myrmecophilous beetles recorded for Ireland, and there is little doubt that many remain to be discovered. Dr. Power recorded *Zyras limbata* Payk., and *Claviger testaceus* Preyss., from the Waterford district in the previous century. *Z. limbata* usually occurs with the ant *Lasius fuliginosus* Latr., which is found sparingly in Ireland. Many interesting beetles are associated with this ant, and it is regretted that no colonies were encountered during the present visit. *C. testaceus* is found with *Lasius flavus,* and *L. alienus* Forst., and according to a note by O'Mahony this beetle has also been taken by Mr. E. F. Bullock at Crosshaven WC. Bouskell (in O'Mahony 1929) examined nests of the wood ant *Formica lugubris* Zett. at Caragh Lake SK. in 1908 and took the Chrysomelid *Clytra quadripunctata* L., the Rhizophagid *Monotoma angusticollis* Gyll., and the Staphylinid *Quedius brevis* Erichs.

Quedius brevis was found during the present visit in a nest of another species of wood ant *F. aquilonia* Yarrow near Churchill AR. Wood ants were found in some abundance in a small area of woodland at the above locality although apparently very scarce elsewhere in Ireland, and the numerous nests here are worth further investigation. Two beetles, *Thiasophila angulata* Er. and *Oxypoda formicetícola Mark.*, are recorded here for Ireland for the first time. They were taken sparingly in ants' nests at Churchill on 23rd June, together with *Oxypoda haemorrhoa* Mann. This beetle commonly occurs in wood ants' nests, but unlike the others the association does not appear to be obligatory since the species has frequently been taken from a variety of other situations and has been recorded in fungi from other counties in Ireland.

STAPHYLINOIDEA

Drusilla canaliculata F. was found to be widely distributed and, as in Britain, seems to be one of the commonest of Staphylinidae. It occurs frequently in the neighbourhood of ants especially *Myrmica*

species, to which it bears a superficial resemblance when running among them. *Staphylinus olens* Müll. was conspicuous and abundant everywhere. *S. erythropterus* L., *S. parumtomentosus* Stein and *S. aenocephalus* Deg. were all taken on high ground in WM and WD. *Creophilus maxillosus* L. was found at Malin ED. The following were all taken variously in SK: *Xantholinus linearis* Cl., *X. angustulatus* Steph., *X. tricolor* F. (at Inch), *X. glabratus* Grav., *Gyrohypnus punctulatus* Groz., *G. angustatus* Steph., *G. myrmecophilus* Kics., *Quedius tristis* Grav. and *Q. mesomelinus* Marsh. *Q. picipes* Mann. was taken at Crohy Head WD. The Irish Silphid *Phosphuga subrotundata* Leach was common in woodland near Clonmel WA and Aherlow ST.

HYDROPHILOIDEA

Helophorus aquaticus L., *H. brevipalpis* Bed. and *H. flavipes* F. occurred in some numbers near Black Head CL. Many of the beetles were flying on to the roof of the car in hot sunshine on 15th June.

HETEROMERA

Cylindronotus laevioctostriatus Goez. was common in heather and birch stumps in WC, SK, WM and TY. *Anaspis rufilabris* Gyll. occurred at Kenmare SK, and *Phylan gibbus* F. was found on Derrymore sandhills NK.

SCARABOIDEA

Geotrupes stercorarius L. was taken on Connor Pass SK and at Killybegs WD, *G. stercorosus* Scr. at Aherlow ST and Pontoon EM, *Melolontha melolontha* L. was seen at Rosbeg WD, *Phyllopertha horticola* L. at Churchill AR, and numbers of dead *Serica brunnea* L. on sand dunes near Malin Head ED.

HISTEROIDEA

Hister neglectus Germ. and *H. duodecemstriatus* Schr. were taken at Woodford SG.

CLAVICORNIA

Telmatophilus caricis Ol. was swept at Toormore WC. *Brachypteros glaber* Steph. and *B. urticae* F. were taken at Churchill AR. *Cryptophagus acutangulus* Gyll. was swept at Schull WC. *Lathridius nodifer* West. flew on to the car at Churchill AR. *Propylea quattuordecimpunctata* L. was taken at Rounstone WG, and *Coccinella septempunctata* L. was general.

BOSTRYCHOIDEA

Grynobius excavatus Kug. was taken at Glengarriff WC.

BYRRHOIDEA

Byrrhus fasciatus Först. occurred on Connor Pass SK.

CANTHAROIDEA

Cyphon ochraceus Steph. and *C. paykulli* Guér were swept at Blackwater Bridge SK. *C. coarctatus* Payk. and *C. padi* L. were taken at Churchill AR. *Rhagonycha lignosa* Müll. was swept near Pontoon EM and *Malthinus flaveolus* Payk. at Lough Conn LE. *Cantharis pallida* Greg. and *C. fulvicollis* F. were general in SK, EM and AR.

ELATEROIDEA

These appeared to be relatively sparse as compared with many areas of Britain. *Hypnoidus riparius* F. was one of the commonest species on high ground in the western counties. *Corymbites cupreus* F. was fairly general in WC, SK, NK and WM. *C. incanus* Gyll. occurred on Connor Pass SK. *Adelocera murina* L. was found on sand dunes near Kilmore WX. *Adrastus nitidulus* Marsh. was swept at Woodford SG. *Agriotes obscurus* L., *A. lineatus* L., *Athous haemorrhoidalis* F. and *A. hirtus* Hbst. were all taken in several localities, including Roundstone WG. The last species was also common at Rosbeg WD. *Dalopius marginatus* L. was taken in SG and LD.

CHRYSOMELOIDEA

Strangalia maculata Poda was swarming on roses near Dromahair LE. *Rhagium bifasciatum* F. was found at Glengarriff WC. *Lochmaea suturalis* Thoms. was generally abundant, and *L. capreae* L. occurred on sallows at Woodford SG and Rosbeg WD. *Donacia thalassina* Germ. and *D. versicolorea* Brahm were swept on boggy ground at Glengarriff and Toormore in WC. *Galerucella viburni* Payk. on guelder-rose and *G. lineola* F. were taken at Taghmon WX, *G. tenella* L. in WC and *G. calmariensis* L. in WG. *Gastrophysa viridula* Deg. was found on dock in ED. *Crepidodera ferruginea* Scop. and *C. transversa* Marsh. were both swept at Glengarriff WC. *Chalchoides aurea* Geof. was abundant on willows, and *C. aurata* Marsh. was taken at Churchill AR. *Haltica oleracea* L. was taken at Lough Conn EM, *Aphthona lutescens* Gyll. on *Lythrum* near Kenmare SK, and *A. coerulea* Geof. was common wherever *Iris pseudacorus* was seen.

CURCULIONOIDEA

Otiorrhynchus atroapterus Deg. was abundant on sand dunes near Kilmore WX, *O. rugostriatus* Goez. was found at Cushendun AN, *O. rugifrons* Gyll. at Aherlow ST, *O. ligneus* Cl. near Clonmel WA, *O. arcticus* F. on Slieve League WD and on moorland LD, and *O. sulcatus* was general in woodland in WC, SK and AN. *Strophosomus sus* Steph. was taken near the Upper Lake SK. This species is not listed in Johnson and Halbert (1902) and may be a new record for Ireland, although it is common enough in Britain. *S. melanogrammus* Först. was also found in the same locality. *Phyllobius argen-*

tatus L. and *Polydrusus cervinus* L. were taken at Cushendun AN. *Sitona regensteinensis* Hbst., *S. striatellus* Gyll. and *S. suturalis* Steph. were swept off gorse and other foliage in SK. *Philopedon plagiatus* Sch., *Phytonomus posticus* Gyll. and *Rhynchites tomentosus* Gyll. were all taken at Blackwater Bridge SK. The latter weevil is local in Ireland and was also found at Kenmare SK. *Barynotus obscurus* F. occurred at Roundstone WG. *Alophus triguttatus* F., *Rhynchaenus salicus* L. and *Cnidorrhinus quadrimaculatus* L. were all taken at Cushendun AN. *Micrelus ericae* Gyll. was locally abundant at Churchill AR, where *Cionus hortulanus* Geof. was also found on *Scrophularia. Nanophyes marmoratus* Goez. on *Lythrum* and *Apion onopordi* Kirb. on the foreshore were taken near Kenmare SK. *A. miniatum* Germ. occurred on dock at Mulrany WM, *Orobites cyaneus* L. on *Viola canina* on the Inch sand dunes SK, and *Balanobius salicivorus* Payk. was swept at Woodford SG. The interesting *Mesites tardii* Curt. was found in old holly trees at Glengarriff WC.

CARABOIDEA

Cicindela campestris L. was very common everywhere, including WM, WD, WC, CL and SK. *Carabus granulatus* L. was also abundant. *C. arvensis* Hbst. occurred at Achill WM, and *C. problematicus* Hbst. at Malin ED. *Broscus cephalotes* L. occurred on the coast in WX.*Notiophilus biguttatus* F., *Harpalus rufipes* Deg., *H. aeneus* F., *Abax parallelopipedus* P. and M., *Calathus melanocephalus* L., *Pterostichus madidus* F., *P. nigrita* F., *Amara fulva* Deg., *A. aenea* Deg. and *A. plebeja* Gyll. were all abundant and widely distributed. *Dicheirotrichus gustavii* Crotch was taken on the coast in CL, the local *Patrobus septentrionalis* Deg. at Achill WM, and *Clivina fossor* L. at Rounstone WG and Cushendun AN.

GENERAL

The writer was mainly interested in looking for phytophagous and plant—associated beetles and the numbers of both species and actual beetles encountered appeared to be rather low in relation to the ground covered. Carabidae and Staphylinidae appeared by contrast to be relatively much more numerous, although only casual attention was paid to them and perhaps less than half of the species seen in these groups were actually collected.

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NOTES ON SOME MICROLEPIDOPTERA

By J. H. STYLES
(*Forest Research Station*)

During routine rearings a number of Microlepidoptera have been recorded either as larvae or pupae on unusual or alternative food-plants.

The list given below includes notes on those species which have been found in conifer plantations, together with a few species which have been bred in the laboratory from old birch logs, stored seed, etc.

Species.	Food-plant from which Larvae or Pupae were collected.	Normal Food-plants.
PHYCITIDAE		
Dioryctria abietella Schiff.	Larvae in Douglas fir cones.	Pine, silver fir and spruce cones, also pine shoots.
TORTRICIDAE		
Batodes angustiorana Haw.	Pupae in pine shoots. Larvae and pupae also on Sitka spruce.	Yew, apple, ivy, etc. Recently recorded on oak, etc.
Archips (= *Cacoecia*) *oporana* L. (= *podana* Scop.)	Larval damage to shoots of spruce and Douglas fir under oak.	Oak, privet. Also a common pest in orchards.
Ptycholoma (= *Cacoecia*) *lecheana* L.	Damage to shoots of young Sitka spruce planted near oak.	Oak, sallow, maple.
Ptycholomoides (= *Cacoecia*) *aeriferana* H.-S.	Species new to Britain, larvae feeding on larch needles.	
Argyrotaenia (= *Eulia*) *pulchellana* Haw. (= *politana* Haw.)	(1) Larval tunnels in the leading shoots of spruce transplants. (2) Pupae spun between the needles of newly planted pine on heather area. (3) Conifer seedlings in forest nurseries.	*Erica, Calluna.*
EUCOSMIDAE		
Eucosma (*Semasia*) *diniana* Guen.	Larval feeding damage to Sitka spruce, larch, Scots pine and *P. contorta.*	Larch, pine.
Eucosma corticana Hbn.	Pupae spun between needles of larch planted under oak.	Oak.

Species.	Food-plant from which Larvae or Pupae were collected.	Normal Food-plants.
EUCOSMIDAE		
Laspeyresia coniferana Ratz.	Larval tunnels under the bark of *P. ponderosa* and *P. radiata.*	Under pine bark.
Argyroploce lacuna Schiff.	Larvae feeding on larch needles.	Polyphagous on low plants; *Salix, Rubus,* etc.
GELECHIDAE		
Exoteleia dodecella L.	Larvae found on larch, pupae between spun needles.	Pine shoots and needles.
OECOPHORIDAE		
Dasycera sulphurella F.	Old birch logs.	In dead wood.
Endrosis sarcitrella L.	Stored walnuts, sawfly cocoons, etc.	Stored seed, dry vegetable refuse, etc.
Hofmannophila pseudopretella Stn.	Severe damage to healthy sawfly cocoons in the laboratory.	Various stored products, dried insects, etc.
Borkhausenia similella Hbn.	Larval tunnels and pupae under the bark of *P. radiata.*	Under the dead bark of pine and sycamore.
HYPONOMEUTIDAE		
Cedestis farinatella Zell.	Larvae mining the needles of Corsican pine.	Scots pine.
PLUTELLIDAE		
Cerostoma radiatella Don.	Larvae feeding on larch needles.	Oak.
TINAEIDAE		
Tinea cloacella Haw.	Old birch logs.	In decayed wood and fungi.

Data have been compiled from laboratory record cards and field survey notes made by members of the Entomology Section of the Forest Research Station, Alice Holt Lodge, Farnham, Surrey.

A list of normal food-plants has been obtained from 'British Lepidoptera' by E. Meyrick (1927) and 'Guide to the smaller British Lepidoptera' by L. T. Ford (1949).

AN ACCOUNT OF REARING *COSYMBIA PUPPILLARIA* (HÜBNER) (LEP: GEOMETRIDAE)

By ROBIN MERE AND G. HAGGETT

The generations of moths described in this account arose from one female taken by Messrs. Edgar Hare, David More and R.M., on 20th May, 1957, in the gardens of Tresco Abbey, Isles of Scilly. This insect was the same night placed in a 3-inch glass-topped tin which had stretched, under the glass, some cotton net. In the tin were placed crumpled soft paper, frayed string, a small spray of Holm oak (*Quercus Ilex*) and another of a type of *Myrtus* (not *M. communis*) which grows freely in the Abbey gardens. Eighty-three eggs were laid during the nights of 20th to 24th, but no egg was laid on the night of 25th May, perhaps not unnaturally since on the 25th the insect was well shaken up during travel by air and car to Surrey: it was killed the following day, being still in reasonably good condition.

A second female, taken in similar circumstances on 22nd May laid 43 eggs before it was killed four days later. Four only of these hatched, one larva died without feeding, and the three moths that resulted were not used for further breeding because the stock was thought to be weak.

The bulk of the eggs were laid along the leaf margins of the *Myrtus,* a few on the Holm Oak, and one or two on the side of the tin itself or on the covering netting. The eggs and the resulting larvae were kept indoors at room temperature; 78 hatched from 31st May to 3rd June and were divided into four unequal batches.

Twenty-five were sent to Mr. Graham Howarth, who sleeved larvae on a small potted plant of *Myrtus* from Tresco: it was thought that the wild Scillies food-plant might well be *Myrtus* because so many eggs had been laid on these leaves. There were signs of feeding, but all the larvae died within a few days.

Twenty-two were sent to Mr. Austin Richardson who fed his larvae on Holm Oak and *Myrtus communis,* mainly on the former, with success. He obtained a number of moths and bred several generations.

Eight larvae were sent to G.H. and became the parents of the generations described in this account.

R.M. kept 23 larvae which produced 22 moths, and this stock, too, was perpetuated throughout the summer.

During 1957 progeny derived from the original Tresco female were distributed to a considerable number of entomologists. It was found that the larvae thrived on the soft young leaves of apparently any type of oak and especially on those of Holm Oak, but when

these were not available the tender young foliage of ordinary Oak, Cork Oak, and Luccombe Oak were equally suitable. *Arbutus unedo*, the Strawberry tree, given as a food-plant by continental authors (as well as privet and Hornbeam), was tried, but ignored by larvae. Except in the special conditions of late autumn described later, the larvae seemed incapable of eating hard or old leaves.

We will now deal in detail with the eight larvae in the care of G.H. and reared so successfully, as were all subsequent generations, by Mrs. R. Haggett, who also kept the records. The eggs were kept separately indoors and larvae were fed on the young leaves of Holm Oak; they completed their growth very quickly, the quickest on the following schedule:

Eggs hatched on 1st to 2nd of June.
Larva first moult not recorded, second moult 7th June, third moult 13th June, fourth moult 16th June.
Pupation on 21st June.
Moth emerged on 1st July.

The slowest pupated on 25th June and produced a moth on 6th July. Five larvae were brown in the last instar and produced brown pupae, three were green and made green pupae, but one died in this stage. Five male and two female moths emerged, one of the latter being a cripple which did not pair.

On 3rd July the healthy female was enclosed with four males, no pairing was observed, but fertile eggs were laid from 5th July until the end of the month; the female lived 33 days and laid a total of 316 fertile eggs, having fed on sugar-water. Some of the earliest laid eggs were again kept under separate observation, giving the following history:

Eggs laid on 5th of July and hatched on 9th July.
Larvae first moult 14th to 15th July, second moult 17th to 19th July, third moult 22nd to 24th July, fourth moult 25th to 28th July.
Pupation on 31st July to 1st August.
Moths emerged on 11th to 23rd August.

Data were kept also on some batches of eggs laid at later dates by the same female, and on 3rd August these were at the following stages of development:

Date of Hatching and Stage

9th and 10th July: 86, mostly pupae, a few spun up but not yet pupated.
10th July: 10 larvae in second to fourth instars.
11th July: 23 larvae in third and fourth instars.
23rd July: 15 larvae in second to fourth instars.

Of the last laid eggs, laid on 30th to 31st July, the slowest feeding larvae were pupating by 4th September. All larvae received the same treatment and were kept in containers together in the same room.

In addition to pairings made between cousins reared by R.M., two unions of this August emergence were made by G.H., between parents especially selected for rosy flushed and red flecked wing colours. Eggs from these were laid throughout the last two weeks of August with pupation beginning on 18th September, and the last to change did so on 7th October. From these two pairings a great many of the earliest laid eggs were distributed to colleagues and we have data only of some 60 larvae, of which about two-thirds reached the moth stage: at the last instar seven larvae were brown, 53 green. The life cycle of most of them was passed as follows:

Eggs hatched	*Pupation*	*Moths emerged*
August 26–27	September 24–25	October 13–30
August 28–29	September 27	October 16-Nov. 7

This third generation had again been reared at indoor temperatures, but these were rather lower than those for earlier broods, while towards the latter part of September it had been necessary to give some older and tougher foliage. The pupae in particular experienced much lower temperatures than those of previous broods, and during the third week of October temperatures as low as 51 degrees F. were reached, climbing again to 56 degrees F. and over for the rest of the month. Considerable losses were suffered not only by this particular brood but also by their relations being bred by R.M., and amongst their more distant relatives being reared by other workers. The greatest losses occurred in the egg state, not necessarily only in the failure of the embryo to develop but also in the inability of the formed larva to hatch. A significant number of deaths occurred in the first instar, and there was, more surprisingly, much mortality in the fourth and last instars. Those crippled moths unable to expand their wings emerged throughout the entire emergence period and appeared to be the result of drying up rather than lacking in inherent vigour. The perfect insect appeared to spend a much longer time lying developed within the pupal shell; few moths of normal appearance were reared, the majority being strikingly banded and rich coloured.

Larvae of this same brood were sent to Dr. Kettlewell, and with one exception these formed pupae and were kept at cold temperatures, but moths emerged during the late autumn, although death rate in the pupa was high. One larva had spun up but had remained quiescent in the pre-pupal state for two months, since September, but then died. Amongst larvae of the same origin reared by R.M., three only pupated; these pupae were kept under cover outdoors but turned black and died.

Amongst the stock held by G.H., a pairing was made on 28th October and for the following fortnight a meagre supply of eggs was laid irregularly in rather cold conditions, and it was not until warmth was given that eggs came at all freely. Eggs were laid from

1st to 20th November, the majority during the latter part of that period in warmth. Most eggs followed the fate of those of the preceding brood in that they passed through the usual colour changes but still failed to hatch. Eighty-three eggs were laid, but less than half hatched and of those a further half died in the first instar. The young larvae were started on such soft secondary growth from pruned Holm Oaks as could be gleaned, but this supply was soon eliminated by hard frosts. By the second week of December only 15 larvae were feeding, the largest becoming fully fed by the end of that month; two larvae only in the penultimate instar in late December continued to feed on older leaves, but both died by the end of February without moulting.

All the larvae had had of necessity to be offered old tough foliage in the later instars, but this they not only ate but they appeared to eat with relish in contrast to larvae of the summer broods. When kept in temperatures of 55 degrees F., to 65 degrees F., the three larvae first to reach full growth suddenly became wasted and they died; at Kettlewell's suggestion the others were put under cooler treatment as they reached the last instar and they continued to feed freely on these leathery leaves during December at temperatures of about 50 degrees F. One spun up on 22nd December and two others by 25th December. By 11th January larvae were still feeding in temperatures that descended at low as 38 degrees F., and during early February, when the temperature climbed again to 50 degrees F., each larva passed from 35 to 45 pellets of frass during a week. The last to pupate did so on 18th February. There were finally nine pupae which were kept indoors in the coldest situation available and they remained there during the periods of severe frost that occurred in February and March. Three died, but the others produced healthy moths which were paired in May, 1958.

The history of this overwintered brood was thus:

Eggs hatched	*Pupation*	*Moth emerged*
November 12	December 29	—
November 12	January 5	—
November 12	February 18	—
November 12	January 5	May 14
November 14	January 8	May 12
November 14	February 1	May 14
November 14	February 3	May 20
November 20	February 9	May 15
November 20	February 10	May 18

Summary of Broods

May, 1957: Wild female taken on Tresco.

Early July, 1957: First generation, one pairing, life cycle five weeks.

Mid-August, 1957: Second generation, two pairings, life cycle five-seven weeks.

October-November, 1957: Third generation, one pairing, life cycle eight-eleven weeks.

May, 1958: Fourth generation, two pairings, life cycle 26-27 weeks.

July, 1958: Fifth generation, several pairings, life cycle eight-ten weeks.

August-September, 1958: Sixth generation, life cycle five-eight weeks.

DISCUSSION

It is evident that, in captivity at least, the moths of *C. puppillaria* live long enough and continue to lay fertile eggs long enough for individuals of the same parents to feed up and emerge over so lengthy a period that broods may totally overlap and a succession of emergences may mix and graduate throughout the summer and autumn; further, there are differences in the rates of growth of larvae from the same parents even when reared under similar treatment; the pupal stage may also be prolonged.

In the wild little is known of the habits of the species in the Scilly Isles, of how it passes the winter or of the number of broods and their duration. The April to May records are expected to belong to one staggered spring emergence, and similarly the July to September emergences may be due to the progeny of the spring moths completing growth at different rates. Survival over the winter may depend on those larvae that hatch late enough to be retarded in development but be early enough to pass the early instars on soft foliage.

Milliere (1859-74. *Iconographie* **3**: 197) states that the larva can be found throughout the year in central France, but that during December and January its growth is slowed. The larva R.M. found wild on Tresco in late September, 1957, pupated not long after and produced a moth in artificial warmth on 26th February, 1958, having been kept under cover outdoors until early January. Mr. Alan Kennard searched for larvae on Tresco in early January, 1958, but he failed to find any, although he discovered that shoots in fair condition were still available higher up on Holm Oak trees. Summer and early autumnal larvae tried on tougher food-plants failed to live, which is in marked contrast to the behaviour of late feeding last instar larvae which fed freely at 50 degrees F., and ate hard old leaves. The length of time spent by winter feeding larvae in the pre-pupal state varied from seven to fourteen days, which although much longer than that of summer examples still does not suggest that *C. puppillaria* could pass the winter in this way.

Too small a proportion of insects were successfully overwintered by us to allow any other than the most tentative suggestions to be

made as to the cause. The majority of autumn larvae—irrespective of generation—attempted to feed until shortage of young foliage resulted in their starvation, while those that had earlier been able to pupate either produced moths within a short time or else blackened and died. We suppose that diapause may be determined in the early larval life possibly as the consequence of a delicate balance between instar and food condition, so that as long as suitable food is available there will be no diapause, but as the leaf chlorophyll content changes by late autumn so the larval behaviour is influenced and late feeding on tougher and older leaves is possible. A prolonged larval life would then last until late winter and the ensuing pupa remain dormant until spring. We think it significant that pupae formed until and during the autumn were unable to overwinter, whereas pupae formed in January and February produced healthy moths after three to four months. However, the pupa from the wild September larva of R.M. kept outdoors under cover until early January and then gently and successfully forced suggests that in nature autumn pupae may sometimes successfully pass the winter.

As young shoots of Holm Oak are well advanced by mid-May in Southern England, and even earlier in the Scilly Isles, there is no reason why this food-plant should not be eaten by all wild broods, although there is equally no evidence that *C. puppillaria* may be restricted to Oak, at least in the Scillies.

The failure of so many eggs to hatch is noteworthy, for this is not confined to inbred stock but was encountered also amongst eggs from a wild caught female; from the 1958 May pairings all the earliest laid eggs hatched healthy larvae, whereas eggs laid long after the males had been removed proved sterile. There is therefore the likelihood that females need to pair more than once, as is well known with some other geometer species.

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100 YEARS AGO

From *The Entomologist's Weekly Intelligencer*, Sat., 18th Dec., 1858.

Haggerstone Entomological Society.—Six months since myself and two or three friends started an Entomological Society under the above title. We have thirty-two members, each member paying one penny per week, twopence for a copy of the rules, and one shilling entrance fee. The Society holds its meetings every Thursday evening, from nine till half-past ten o'clock, at the 'Carpenters' Arms', Martha Street, Haggerstone: the average attendance of members is about twenty. In the first quarter (Mr. Sayers in the chair) we expended 19s. in books. During the second quarter (myself in the chair) we purchased an uncoloured edition (the first) of Wood's 'Index Entomologicus' for 30s., and have at this moment a balance of £1 3s. 7d. in hand.—C. Healy, 4 Bath Place, Haggerstone, N.E.; 10th Dec.

ON THE REDISCOVERY OF *ATHYSANUS ARGENTATUS* (FAB.) (HOM. CICADELLIDAE) IN BRITAIN

By M. A. SALMON, *F.R.E.S.*

In 1956 Lt.-Col C. A. W. Duffield, of Ashford, Kent, took a series of a large and unfamiliar leaf-hopper amongst long grass at Sandwich. This was identified by Mr. R. J. Izzard at the British Museum (Nat. Hist.) as *Athysanus argentatus* (Fab.), a species known only from Southern France, Eastern Europe, Turkestan and Siberia (Ribaut, 1952). No recent record of this species being taken in Britain was known, and as here was no mention of it in either James Edwards' (1896) or G. B. Buckton's (1891) monographs, it was assumed that *A. argentatus* was entirely new to this country. It may be mentioned here that there were no specimens in the National Collection, either from this country or from abroad.

However, the Rev. T. A. Marshall, writing in the middle of the last century, contributed a series of papers to the *Entomologists' Monthly Magazine* under the collective title of 'An Essay towards a knowledge of the British Homoptera', in which he described the species known to him at that time. His descriptions, which are in Latin, include that of *Iassus* (= *Athysanus*) *argentatus* (Fab.). There can be no doubt that this description is of the same species as was taken by Lt.-Col. Duffield at Sandwich in 1956. Further evidence is found in the paragraph following Marshall's description, 'Apparently an unusual species in this country but once taken by me in abundance on water plants growing in a shallow pond by the side of the road from Ramsgate to Sandwich, in September'. Thus it can be seen that the first record of *A. argentatus* in Britain was made by the Rev. T. A. Marshall and that it has taken nearly one hundred years for a second capture to be made. How Marshall's record came to be overlooked by all subsequent authors we will never know, but it has never been mentioned in any monograph on the British species. It seems all the more remarkable when it is realized that this species is common and widely distributed along the South Coast. It is now known that G. G. E. Scudder took a single specimen on Folkestone Warren in 1951, but this remained unidentified until more recently. During the last two years *A. argentatus* has been taken from the following localities. Kent: Sandwich (two colonies known to the writer, 1956), Dungeness (Lt.-Col. C. A. W. Duffield, 1956); Suffolk: Walberswick (H. W. Daltry, 1956); Sussex: Pevensey Bay (W. J. Le Quesne, 1957); Hampshire: Portchester (W. J. Le Quesne, 1957).

Athysanus argentatus (Fab.)

Cicada argentata Fabricius, J. C., 1803, *Systema Rhyngetorum*. p. 71.
Jassus id. Herrich-Schaëffer, G. W., 1829, *Fauna Germanica*. **126**: 5.
Iassus (*Athysanus*) *argentatus* Marshall, T. A., 1866. *Ent. mon. Mag.* **3**: 9.
Athysanus id. Sahlberg, J., 1871, *Ofversight af Finlands och der Scandinaviska halförs Cicadariae*. p. 262.
Melichar, L., 1896,*Cicadinen von Mitteleuropas*. p. 262.
Blöte, H. C., 1927, *Fauna van Nederland*. (2): 32.
Ribaut, H., 1952, *Faune de France*. **57**: 107.
Dlabola, J., 1954, *Fauna CSR*. **1**: 233.
Euscelis id Haupt, H., 1936, *Die Tierwelt Mitteleuropas*. **4**: 199.
Length for both sexes: 7-8 mm.

The general colour is grey or dirty white. Lorae, genae and clypellus pale yellow. Clypellus rectangular. Antennal fossae with transverse ridge above. Clypeus pale grey with fine transverse striations on each side of mid-line. A single black dot above each antenna. Frontal sutures terminate at ocelli. Ocelli on anterior marg'n of vertex very near eyes. Vertex broadly rounded, with a conspicuous curved black line joining both eyes. Pronotum nearly twice as long as vertex. Scutellum with a median longitudinal black line which terminates just short of the apex. Elytra grey. Costal margin broadly yellow or cream. Five apical cells. A single transverse nervure anterior to the apical cross veins. Appendix very narrow; fuscous. Clavo-corial suture fuscous. Nervures pale. All areas with a variable median fuscous stripe. Abdomen yellow with a variable black band on either side of the mid-line. Wings hyaline with nervures pale, except peripherally where they are fuscous.

This species is abundant on coarse grasses in damp surroundings, and in this country has only been taken near the coast—Kent, Suffolk, Sussex and Hampshire—June-September. At Sandwich it occurred in company with *Rhytistylus proceps* (Kirsch.), *Graphocraerus ventralis* (Fall.), *Calligypona pellucida* (Fab.), and *Eurybregma nigrolineata* Scott.

ACKNOWLEDGMENTS

I am indebted to Lt.-Col. C. A. W. Duffield for his great help and interest, and to Mr. R. J. Izzard of the British Museum (Nat. Hist.) for guidance in this problem.

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FIG. 1. ATHYSANUS ARGENTATUS (FAB.) ♀

A COLLECTION OF FLEAS (SIPHONAPTERA) FROM ST. KILDA

By R. S. GEORGE, F.L.S., F.R.E.S.

The life on the islands round our coasts has interested both zoologists and botanists for many years and a multitude of references is scattered throughout the literature. Inevitably the more popular groups have received the greater amount of attention . . . it is very satisfying, therefore, to have the opportunity of examining the largest collection of fleas to have been made on the most distant of our islands, St. Kilda. This has been possible through the energy of Mr. Kenneth Williamson, acting as Warden for the Nature Conservancy in August and September, 1957, and the co-operation of Dr. J. Morton Boyd, of the Conservancy's headquarters in Edinburgh, who made the collection available to me. To these gentlemen I extend my most grateful thanks.

The recorded flea fauna of St. Kilda, prior to the 1957 collections, consisted of five species: *Pulex irritans* L. (Evans, 1906; Hopkins and Rothschild, 1953; Waterston, 1906); *Dasypsyllus g. gallinulae* (Dale), (Rothschild, M., 1952); *Nosopsyllus fasciatus* (Bosc), (Smit, 1957); *Ceratophyllus vagabundus insularis* Roths. (Rothschild, M., 1952; Waterston, 1906); and *Ceratophyllus borealis* Roths. (Rothschild, N. C., 1907; Rothschild, M., 1948 and 1955). All these references are listed in Smit, 1957.

During August and September, 1957, the island was visited and Mr. Williamson trapped just over 200 mice and sent several wrens' nests to the Hon. Miriam Rothschild, who reported (1958) the presence of seven species of fleas in them: the previously recorded *gallinulae, fasciatus* and *borealis,* and also the first records from the island of *Ctenophthalmus nobilis vulgaris* Smit, *Typhloceras poppei* Wagner, *Ceratophyllus g. gallinae* (Schrank), and *C. garei* Roths. Of these, *fasciatus, poppei* and *vulgaris* are rodent fleas, they all came from the same nest, and their occurrence indicates either co-habitation of the nest by a rodent (almost certainly the St. Kilda Field Mouse, *Apodemus sylvaticus hirtensis* Barrett-Hamilton) and a St. Kilda Wren (*Troglodytes troglodytes hirtensis* (Seeb.)) or the very close proximity to the wren's nest of a rodent nest. Williamson also tubed the fleas from the mice and passed them to Boyd, who in his turn submitted them to me for determination. Only three species were present: *Ctenophthalmus n. vulgaris, Typhloceras poppei* and *Nosopsyllus fasciatus.* A comparison of the field collecting schedule and my own lists after determination shows a few minor discrepancies which suggest that a few fleas have been lost, but an analysis of the trapping records and the fleas seen by me is given in Table 1. Williamson was not certain of sexing juveniles at first and the 42 juveniles taken

in the first 91 animals trapped are grouped together; after the ninety-first animal he was confident of his sexing. Juveniles are considered to be those weighing up to 25 grams. I have ignored the few mice which escaped before weighing, a few mice for which I have not the full details, and where in the records fleas from three male mice were grouped together I have counted them as from three individual hosts, as the fleas could just as easily come off all three mice as off one or two only. The flea index refers to the average number of fleas per mouse.

Table 1

	All mice	Juv. Sex incert.	Juv. ♂♂	Juv. ♀♀	All Juv.	Adult ♂♂	Adult ♀♀	All Adults
Total No. examined	203	42	27	30	99	47	57	104
Total infested	98	11	12	11	34	38	26	64
Per centage infested	48·27	26·19	44·4	36·67	34·34	80·85	45·61	61·52
No. fleas determined	384	19	32	32	83	204	83	301
Flea index	1·89	·45	1·18	1·07	·84	4·34	1·46	2·89
Flea index/ infested hosts	3·99	1·73	2·67	2·91	2·44	5·37	3·19	4·70

From these figures we see that the adult hosts are infested to a greater degree than juveniles, and that the adult males have both a higher infestation rate and a higher flea index than any other group of the hosts. The adult males are, therefore, the chief vectors of the fleas and, presumably, of any flea-borne infection. The figures confirm those obtained from Corbet's captures on the Scottish mainland (George & Corbet, *in press*), and it is most interesting to see that Williamson, in his notes from St. Kilda addressed to Boyd, came to the same conclusion concerning the importance of the adult ♂♂ as flea-vectors as Corbet and I, even though there is no published reference to this feature of the fleas' ecology (Smit, *in litt.*, i.x.1958). The reason for the fleas' preference for adult ♂ hosts must be left to those who have adequate laboratory facilities.

In actual fact I examined 392 fleas as detailed in the comments against each species:

Ctenophthalmus nobilis vulgaris Smit, 143 ♂, 199 ♀, 41.8 per cent. ♂♂, comprising 82.7 per cent. of the total, is by far the domi-

nant species of rodent flea on the island. It is known, in the specific form, from almost every county of the British Isles and from almost every Scottish island from which rodent fleas have been collected. *Apodemus* is the most commonly favoured host, although *Microtus, Clethrionomys, Rattus, Sorex* and *Talpa* species frequently carry it. There can be no doubt that this flea is part of the indigenous fauna of St. Kilda.

Nosopsyllus fasciatus (Bosc), 8 ♂, 20 ♀, 28.6 per cent. ♂ ♂, comprising 7.1 per cent. of the total, is normally parasitic on *Rattus* but frequently is found on *Apodemus*. It could easily be an indigenous member of the island's fauna, but just as easily it could have been introduced on mice or rats from visiting ships.

Typhloceras poppei Wagner, 5 ♂, 17 ♀, 22.7 per cent. ♂ ♂, comprising 5.6 per cent. of the total, is monoxenous on *Apodemus* but, as on St. Kilda, normally provides only a small portion of the fleas on its host. It has been recorded (Smit, 1957) from Arran, Cumbrae, Fair Isle, Lewis and Shetland of the Scottish islands, but nowhere on the Scottish mainland, from several of the southern counties of England and Wales, from the Isles of Wight and Scilly and Bardsey (M. Cotton, verbally, new record), from Co. Dublin and Co. Wicklow in Ireland, and the Irish islands of Clare and North Bull. Its distribution in the British Isles is, therefore, bi-partite, i.e. the southern third of the mainland together with its associated islands, and the islands of the north. Recent collecting in Scotland and Mull (George & Corbet, in press) suggests that it is not in those areas. The considerable variation existant in this species has long been known (Jordan and Rothschild, 1914, p. 236), and while I observe no difference between the St. Kilda specimens and those from the south of England, it is interesting to conjecture as to the possibility of this northern island population of *poppei* evolving at least to a subspecific form. Such a possibility can best be followed with the aid of the mammalogists to whom the island mice present so many problems.

It is most satisfying to note the absence of *Malaraeus penicilliger mustelae* (Dale) from the collection, thus providing another piece of evidence to the opinion that this flea is dependent upon the voles, and more probably upon *Clethrionomys*, these animals themselves being absent from St. Kilda.

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1 Podsmead Place,
Gloucester.

ANARSIA LINEATELLA ZELLER (LEP., GELECHIIDAE) IN BRITAIN

By R. W. J. UFFEN

On 8th August, 1957, I reared, from a fully-grown chocolate-brown larva found tunnelling in the flesh of an imported apricot, a moth which Mr. J. D. Bradley kindly determined for me as *A. lineatella.* Since the species does not appear to have been noted in generally accessible British literature, a note on its status may be appropriate.

Continental key works distinguish *lineatella* from *spartiella* Schr., which occurs in Britain, as follows:

Forewings yellowish-grey mixed brownish; expanse over 15 mm. ..... *spartiella* Schr.

Forewings dark grey with longitudinal black streaks; expanse up to 14 mm. ..... *lineatella* Zell.

The series in the British Museum is very variable as to wing-pattern.

Lhomme's *Catalogue des Lépidoptères de France et de Belgique* states the species to be rather common in France, although most of the records quoted seem to be from the southern half of the country. The food-plants are given as plum, blackthorn, peach, apricot, apple, pear and almond. I am indebted to Mr. W. L. Rudland for the following summary of the information given by Balachowsky and Mesnil (1935. *Les Insectes Nuisable aux Plantes Cultivées:* **1,** Paris.) to which Lhomme refers.

'Occurs throughout temperate and southern Europe, Palestine; introduced into U.S.A., Australia, Japan and China. Affects mainly peach and almond, less frequently plum and cherry.

'The young larva hibernates in an excrement-covered web at a twig joint. It then feeds only in shoots, causing a gummy exudation and entering as many as four or five young shoots. Damage caused by this generation is considered serious only in nurseries. Pupation takes place in a fold of a leaf, the imagines emerging in about ten days (in June). Ova are laid on the underside of the leaves and hatch in ten to fifteen days. A few larvae of this second generation feed in shoots, but most bore in the fruit. The borings have a slight cap over the entrance hole. The larvae pupate in folded leaves or spin up in the hollow around the stem of the fruit. The adults emerge in August. The moths are nocturnal and keep to the shade of the foliage by day.'

Fruit imported into Britain is thoroughly, and from the paucity of records successfully, inspected to intercept this and other pests which might become established here. I am told that young larvae may be killed by refrigeration, whilst older ones often leave the fruit as soon as it is taken out of cold storage, so that the consumer usually finds only empty borings. I understand that more fruit than usual was infested in 1957, so other specimens may have been reared.

4 Vaughan Avenue, London, W.6.
31st November, 1958.

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100 YEARS AGO

The Entomologist's Annual for 1858 recorded new British species of Coleoptera and Lepidoptera taken in 1857.

No fewer than 84 Coleoptera were added to the British List in 1857—of which one was a new species, i.e. *Euryusa Kirbyi* Janson.

The 15 Lepidoptera noted from Great Britain for the first time make an interesting list and contains no fewer than three new species described by the editor (H. T. Stainton).

The list is as follows: "*Aspilates sacraria* Linn., *Eupithecia helveticaria* Boisd., *Sciaphila cinctaria*, W.V., *Depressaria bipunctosa*, Curtis, *Gelechia albipelpella*, H.-S., *G. arundinetella*, Zell., *Coleophora ibipennella*, Heyden, *C. apicella*, n. sp., *C. chalcogrammella*, Zell., *Tischeria angusticollella*, Heyden, *Nepticula Myrtillella*, Edleston, *N. Poterii*, n. sp., *N. Glutinosae*, n. sp., *N. arcuata*, Frey, and *Pterophorus Loewii*, Zeller."

In *The Entomologist's Weekly Intelligencer*, Sat., 30th Oct., 1858, was announced the discovery of '*A new British Noctua*'—*Xanthia ocellaris*. Two collectors announced the capture of this species at Brighton. Mr. Lewis Tidey having taken a specimen on 18th Sept., and Mr. Henry Pratt took a female on 21st Sept., 1858.

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